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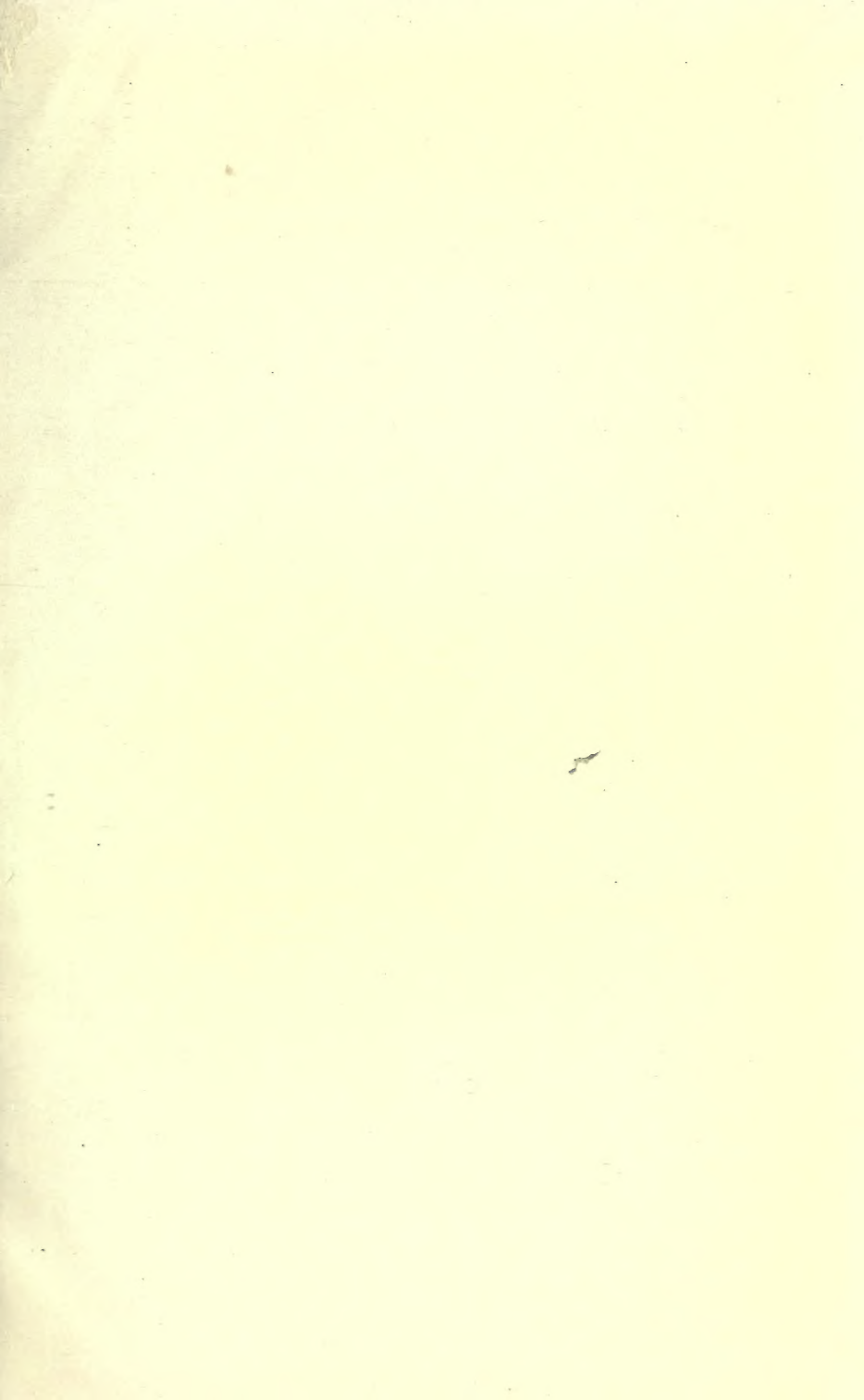


PLATE I.

A DISSECTION TO SHOW THE ANATOMICAL RELATIONS OF THE INTERIOR
OF THE NOSE, RHINO-PHARYNX, PHARYNX, AND THE VARIOUS
STRUCTURES ENTERING INTO THEIR FORMATION.



A vertical mesial section has been made, and the septum [nasi (1) cut and raised to show the structures on the outer wall of the nose, the posterior margin of the septum nasi (2) being left *in situ* to show its relations to the Eustachian tube, etc.; (3) the superior, (4) the middle, (5) the inferior turbinated bodies, collapsed and shrunken, beneath which are respectively the superior, middle, and inferior meatuses. The left sphenoidal sinus has been broken into and a bristle passed through its aperture of communication with the superior meatus. More anteriorly, in the superior meatus, is seen a bristle passed into an opening into the posterior ethmoidal cells. Additional apertures are seen beneath this bristle; (6) the vestibulum nasi; (7) corresponds with the interpeduncular space, the anterior cerebral artery appears immediately in front of the figure; (8) the body of the sphenoid; in the middle meatus is seen a bristle (9) passed upwards and forwards through the hiatus semilunaris and infundibulum, to the frontal sinus; (10) is placed on the salpingo-palatine fold, the orifice of the Eustachian tube is seen, and behind it (11) the salpingo-pharyngeal fold, the fossa of Rosenmüller being above and behind the posterior lip of the Eustachian tube; (12) a bristle passed into the lower end of the nasal duct; (X) Agger nasi, and below this eminence is the atrium meatus medii.

(From a dissection in the Museum of the University of Bristol.)

RHINOLOGY

A TEXT BOOK OF DISEASES OF THE NOSE AND THE NASAL ACCESSORY SINUSES

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TO

SIR FELIX SEMON, K.C.V.O., M.D., F.R.C.P.,

PHYSICIAN EXTRAORDINARY TO HIS MAJESTY THE KING,

AND

WHOSE ORIGINAL RESEARCHES AND CONTRIBUTIONS TO LARYNGOLOGY

AND RHINOLOGY HAVE SO MARKEDLY ENRICHED AND ADVANCED

THIS SPECIAL BRANCH OF MEDICAL SCIENCE,

THIS VOLUME IS GRATEFULLY

DEDICATED BY THE

AUTHOR.

P R E F A C E

As his former work on the Nose and Throat, which reached the fourth edition, has now been out of print for several years, the author trusts that this text book on Rhinology, based on his earlier treatise, and the corresponding volume on Laryngology, shortly to appear, will prove equally serviceable to the practitioner and advanced student. The fact that the text occupies double the space devoted to Rhinology in the fourth edition of that former work is due to the rapid progress in this speciality during the last ten years.

The author's endeavour has been to present concisely the science as well as the practice of rhinology, since practice which is not founded on scientific principles becomes empirical, and the practitioner lacks the knowledge which alone can guide him through the maze of ever new operations and methods of treatment inevitable in any relatively young and rapidly developing branch of medical art. To fulfil conditions essential to an ideal text book, dogmatic statements are restricted to well-ascertained facts, while on debatable ground the opinions of the chief authorities on diseases of the nose are stated, as far as possible in the limited space, in order that the student may be guided to intelligent choice of alternatives in practice.

In addition to the numerous flat plates, sketches, and coloured drawings introduced throughout the text, the series of stereoscopic pictures, every one of which displays important points in the study of diseases of the nose, can hardly fail to leave more

accurate and vivid impressions on the memory than could be achieved by any other means.

The clinical anatomy of the nose, and particularly of the accessory sinuses, has been treated with much care, because accurate anatomical knowledge is essential to rhinology, and alone can justify confidence in operating. It may be difficult to the beginner to bear in mind the frequent anatomical variations in the accessory sinuses, but it is disastrous in practice to ignore them. The author is especially grateful to Professor Zückerkandl, of Vienna, for permission to present stereoscopic pictures of his most instructive specimens; to Professor Onodi, of Budapest, for the series of plates illustrating the anatomical relations of the nasal sinuses to the orbit, which must prove as helpful to the ophthalmologist as to the student of rhinology; and to Professor Shambaugh, of Chicago, for kindly placing at his disposal other anatomical preparations and drawings of great practical value, though he has utilized his own specimens where these better serve the purpose of illustration.

To Professor Gerber and to Drs. Hajek, Tilley, Roe, Lack, Parker, Delsaux, and to many others whose names are mentioned in the text, he is much indebted for kindly help, and for the loan of illustrations in this volume; and to his former house surgeon, Mr. A. J. Wright, for revising the whole of the proof sheets. To Messrs. J. Wright & Sons Ltd., of Bristol, the printers of this volume, and to the Editor of the "*Zeitschrift für Laryngologie*," for permission to use illustrations Nos. 16 to 19, the author is indebted.

P. W. W.

Bristol, 1910.

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RHINOLOGY.

SECTION I.

EXAMINATION OF THE NASAL PASSAGES

ANTERIOR RHINOSCOPY
POSTERIOR RHINOSCOPY

MEDIAN RHINOSCOPY
CONGENITAL DEFECTS

THE nasal passages are examined from the front—*anterior rhinoscopy*,—or from behind, through the mouth, by means of the rhinoscope—*posterior rhinoscopy*. The patient and examiner sit facing one another, the light being arranged as in laryngoscopy. In examining the interior of the nose it is necessary to observe

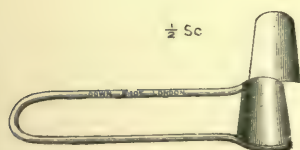


Fig. 1.—Thudichum's speculum.

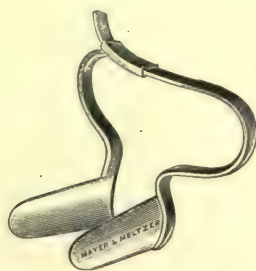


Fig. 2.—Author's modified Browne's speculum, self-retaining.

not only the presence or absence of pathological conditions within the nasal passages, but also to note any indications of disease involving the accessory sinuses which open into the nasal fossæ. For rhinoscopy a brilliant illumination is even more essential than in laryngoscopy, while the same forehead mirror of about fourteen-inch focus should be used.

Anterior Rhinoscopy.—For this we require a nasal speculum. Fränkel's is simple, but the vibrissæ are apt to project through the fenestræ of the blades and obscure the parts beyond, and therefore I think that for general use one of the best is one consisting of two ivory blades on sliding bars, as it may be used in cautery operations as well as for examination purposes. The spring of Thudichum's is liable to cause pain, unless very carefully held. The most comfortable to the patient is Bresgen's, but it is more difficult to manipulate.

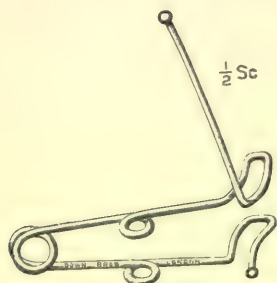


Fig. 3.—Hefermann's self-retaining nasal speculum.

Some form of self-retaining speculum, like the one illustrated, is desirable for operations on the nose requiring two hands. A few fine silver probes, such as Pegler's, to investigate the nature and consistency of the various prominences and swellings encountered, complete the apparatus for anterior rhinoscopy.

Having previously inquired for any symptoms noticed by the patient, such as nasal obstruction, discharge, foul odour, loss of smell or taste, pain, sneezing, etc., let the light be focussed on the anterior nares. But before introducing the nasal speculum, raise the tip of the patient's nose and examine the vestibule and the front part of the nasal passages; otherwise ulcers, septal perforations, or other abnormalities may be subsequently concealed by the blades of the speculum and escape detection.

Then, with the patient's head very slightly retracted, insert the speculum and gently separate the blades, directing the light well into the passage. Observe the olfactory fissure, and note its width, and whether there are any collections of abnormal secretion. The inner wall is formed by the septum, covered with yellowish pink mucous membrane; any departure from the normal contour, the presence of ulceration, new growths, septal deviations or perforation will be easily recognized here.

On inspecting the outer wall, the inward projection of the inferior turbinated body first arrests attention. Even when healthy it varies considerably in colour and size, according to the state of the erectile tissue; for when the venous sinuses are distended the turbinal body appears as a red or pink, tense swelling, as shown in *Plate II*,

Fig. 3; but when collapsed it appears pale pink, and is much less prominent. The turbinals are shown in this figure in a state of distention.

By directing the patient to throw the head well back so that the light is directed towards the roof of the nose, we bring into view the anterior portion of the middle turbinated body, which is similar to the inferior in colour and consistence. In a very few patients only can the superior turbinated body be distinguished, far back and high

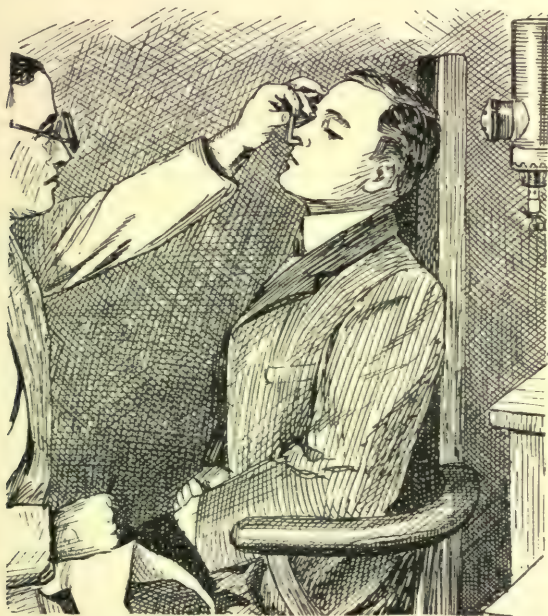


Fig. 4.—Position of patient, lamp, and examiner for anterior rhinoscopy.

up. The presence of polypi in the middle meatus, or any discharge of pus here, should lead to a careful investigation of the region of the *hiatus*, while the existence of any growth, ulcerated surface, collections of crusts or secretion, spurs or deflections of the septum will be observed. Sometimes it is possible to see the posterior pharyngeal wall through the normal nasal passages, and then, on swallowing, the salpingopalatine fold is seen crossing inwards.

Persistence or loss of sensibility, or the existence of hyperæsthetic spots, may be determined by touching the lining mucous membrane with a probe. The nasal probe is also employed to investigate the consistence of any growth, and whether it is fixed or movable; vascular engorgement of the turbinal bodies gives the sensation of a cyst distended with fluid, and pits on pressure. By spraying the parts with a solution of cocaine or novocain and adrenal extract, the vessels are emptied, and the swelling due to simple vascular disten-

tion disappears, and thus not only do we get a clearer view of the parts beyond, but we can determine how much of any swelling is due to vascular engorgement, and how much to true hyperplasia of the tissues. A fresh solution (2 to 10 per cent) of suprarenal extract or powder is a more potent astringent than cocaine, and it is sometimes desirable to use it alone, or after cocaine, to obtain a more perfect inspection of a narrow nasal passage.

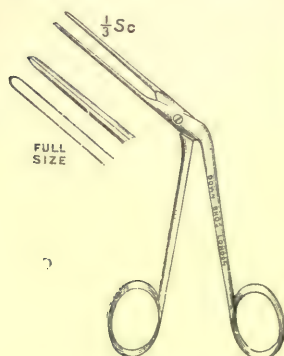


Fig. 5.—Stanley Green's nasal forceps for holding pledgets of wool to wipe up secretion, etc.

Posterior Rhinoscopy is more difficult of accomplishment, and requires considerable practice before a satisfactory examination can be made. One of the smaller laryngeal mirrors (half inch diameter), with the shank bent slightly

downwards, may be used for the purpose, but a special form of rhinoscopic mirror, such as Fränkel's or Michel's, with a movable mirror, is much easier to manipulate. Dan Mackenzie's convex mirror rhinoscope affords a more complete image of the rhinopharynx than any flat mirror.

Direct the patient to open the mouth without protruding the tongue, the head being erect; then with the left hand depress the dorsum of the tongue. For this purpose either Fränkel's or Türk's depressor is very convenient, as the form of the handle enables the left hand to be kept well out of the way of the right, which holds the rhinoscope. In using it care must be taken to place it just beyond the dorsum of the tongue, and no further; for if not far enough back the tongue bulges up and occludes the view, while if too far back gagging and retching are induced.

A successful examination can only be obtained by carefully avoiding

any titillation of the fauces on introducing the mirror, and by setting the patient completely at ease. I generally find it is better to give no directions as to the manner of breathing, but simply to let the patient breathe quietly, and generally the soft palate will very soon relax spontaneously. If it does not do so, instruct the patient to

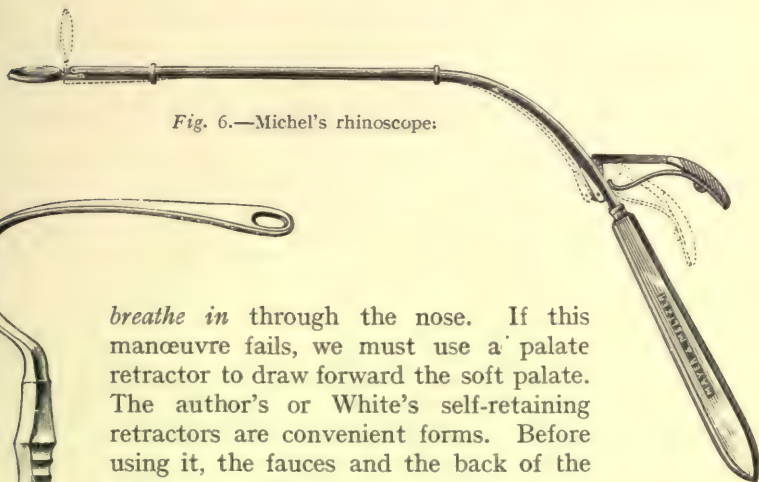


Fig. 6.—Michel's rhinoscope:

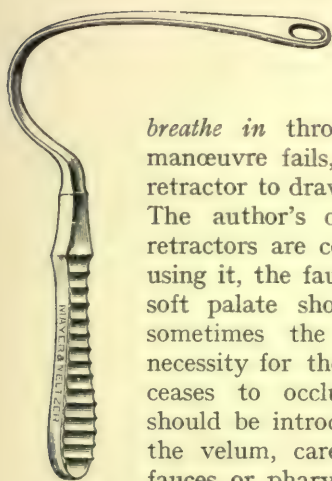


Fig. 7.
Fränkel's
tongue
depressor.

breathe in through the nose. If this manœuvre fails, we must use a palate retractor to draw forward the soft palate. The author's or White's self-retaining retractors are convenient forms. Before using it, the fauces and the back of the soft palate should be cocaineized, and sometimes the application of cocaine obviates the necessity for the retractor. As soon as the soft palate ceases to occlude the naso-pharynx, the rhinoscope should be introduced and passed below and well behind the velum, care being taken to avoid touching the fauces or pharyngeal wall.

First, by gradually tilting forward the mirror till it assumes an angle of about 45° , as shown in the diagram (Fig. 8), the posterior border of the septum nasi is brought into view in the centre of the image; it forms a convenient landmark (*see Plate II, Fig. 2*). Then on slightly turning the mirror, first to one side, then to the other, the *choanæ* or posterior openings of the nasal passages come into the field, and, projecting inward, the posterior extremities of the inferior and middle turbinal bodies appear as "frogspawn-like," greyish-white bodies. Owing to the very oblique direction in which the parts are viewed in rhinoscopy, the lower turbinals appear to rest on the

upper surface of the soft palate, the inferior meatus being seldom seen at all. Sometimes the superior turbinal can be dimly seen in the upper part of the choanæ. Below, the superior or posterior surface of the soft palate and uvula come into view, and, turning the mirror to

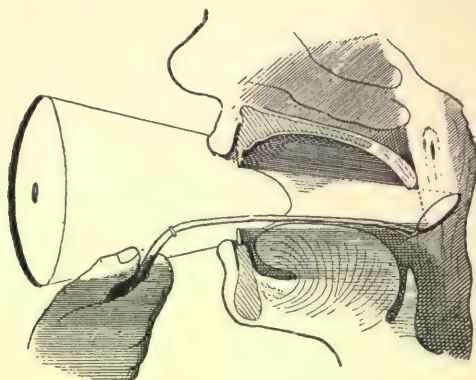


Fig. 8.—Posterior rhinoscopy (Carwardine).
(From the author's article in "Carwardine's Practical Surgery.")

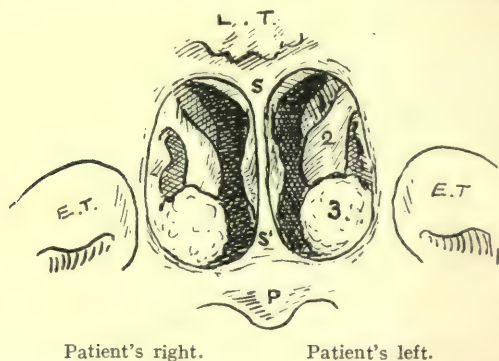


Fig. 9.—Explanatory diagram of the rhinoscopic image, Plate II, Fig. 2 :

S, the septum, on either side of which are the *choanæ narium* ; 1, 2, 3, the left superior, middle and inferior turbinated bodies ; E.T., the left and right Eustachian tubes ; P, posterior surface of the uvula ; L.T., Luschka's or the pharyngeal tonsil.

either side, we can see the orifices of the Eustachian tubes, and behind them the fossæ of Rosenmüller. Finally, after once more finding the posterior border of the septum, which acts as a convenient



FIG. 1.



FIG. 2.



FIG. 3.

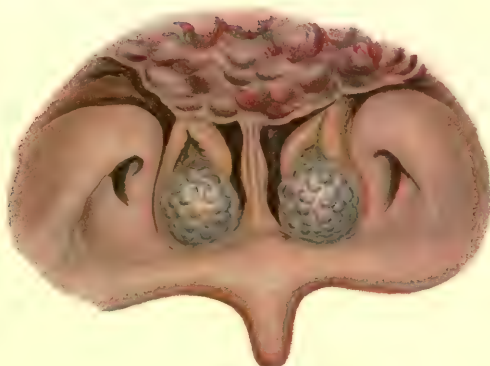


FIG. 4.



FIG. 5.



FIG. 6.

FIG. 1.—View of the nasal passages by anterior rhinoscopy.

FIG. 2.—The posterior rhinoscopic image in a healthy adult.

FIG. 3.—Vascular engorgement of the inferior turbinated bodies.

FIG. 4.—The posterior rhinoscopic image in an adult showing adenoid growths in the vault of the rhinopharynx, and hypertrophy of the inferior turbinated body.

FIG. 5.—Scleroma of the nasal passages, anterior view. (Gerber.)

FIG. 6.—Scleroma by posterior rhinoscopy. (Gerber.)

landmark, the roof and posterior wall of the rhino-pharynx are successively brought into view, as the mirror becomes more and more horizontal before it is withdrawn.

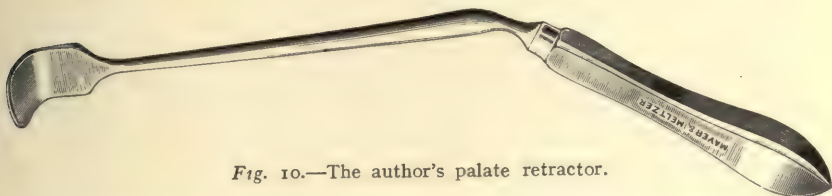


Fig. 10.—The author's palate retractor.

Of course only small portions of the rhino-pharynx can be seen in the rhinoscopic mirror at any one time, but by mentally connecting the several successive images we obtain a complete rhinoscopic image as depicted on the plate.

While making the examination, the presence of any growth or collections of secretion, or other abnormalities, should be carefully noted. The presence of a certain amount of lymphoid tissue in the vault and posterior wall is normal in children up to the age of about 16 to 20. In some cases this pharyngeal tonsil shows the "recessus medius" very plainly, or even a short tubular recess.

It is scarcely necessary to add that the rhinoscopic examination must be very rapid, and very often we have to make several short successive examinations, or even be satisfied with such a momentary glance that only a practised eye could see the condition of the parts.

Median Rhinoscopy.—By means of the long thin-bladed nasal speculum of Killian it is possible to bend outwards the middle turbinal sufficiently to get a good view of the upper and posterior regions of the olfactory fissure, thus yielding a good view of the sphenoidal sinus ostium and other parts that it may be important to inspect. Before introducing the instrument the parts should be cocainized, and then, to use Killian's words, the speculum is inserted between the middle turbinal and the septum, dilatation with moderate pressure is made,

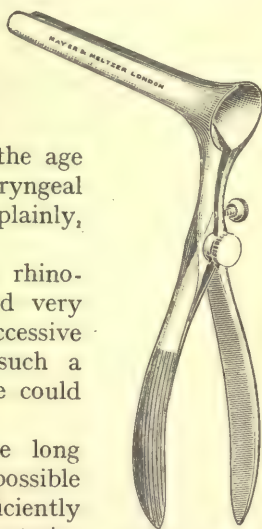


Fig. 11.—Killian's speculum for median rhinoscopy.

and the instrument is gently pushed onward to the anterior surface of the sphenoid. The blades are alternately opened and closed, and the patient is instructed to remove by snuffing the accumulating mucus and blood. By similar methods of procedure the middle or the inferior meatus can also be inspected.

Congenital Defects and Deformities.—We need not here refer to mere cosmetic congenital defects of the nose, which are described in connection with their treatment in Section IX. A central depression at the tip of the nose which is analogous to hare-lip or cleft-palate is one of the rarest defects.



Fig. 12.—Case of malformation of the nose (W. R H Stewart).

It is not very unusual to find the anterior orifice of the nasal passages partially obstructed by a web-like band projecting up from the floor of the vestibule about half an inch from the margins of the alæ. Very rarely this web of skin completely occludes the nasal passages, representing the persistence of a condition analogous to the congenital web sometimes observed partially occluding the glottis. I have seen more than one such case; another is recorded by Jarvis.

A congenital osseous occlusion of the posterior nares, either unilateral or bilateral, is sometimes met with.

The most frequently occurring congenital defect is deviation of the septum. It is, in fact, unusual to find a septum which is perfectly straight, the most common defect being a longitudinal ridge corresponding to the junction of the maxillary crest and the lower border of the vomer. Normally the vomer is received into the groove of the crest, but in process of development the lower border of the vomer may rise to either side of the crest, forming there a very definite longitudinal vomerine crest or ridge. The condition is referred to more fully under the head of deviated septum. The septum has been found to be doubled (splitting of the septum), and very rarely the septum is continued back into the naso-pharynx, which is then divided into two chambers more or less completely. The posterior portion of the septum formed by the ethmoid plate may be invaded by a sphenoidal sinus, a very rare occurrence (see p. 30.)

Jacobson's Organ.—A small tubular recess corresponding with the situation of Jacobson's organ has been stated to occur occasionally, but I have never met with anything of the kind. The organ of Jacobson is only a foetal structure in man, but is the representative of a well-developed tubular recess in some quadrupeds, and as considerable branches of the olfactory nerve have been demonstrated in the lining epithelium, it is probably an olfactory organ of considerable functional importance in some of these lower animals.

To render the developmental origin of these congenital defects clear, the development of the nose in the embryo is briefly described in the following section (p. 31).

SECTION II.

ANATOMY AND PHYSIOLOGY.

THE NOSE AND NASAL PASSAGES
ACCESSORY SINUSES OF THE NOSE

DEVELOPMENT OF THE NOSE
INNERVATION OF THE NOSE

IN a work addressed to medical practitioners and senior students it may be assumed that every reader is acquainted with the topography of the regions under discussion, and has at hand the usual text-books of anatomy and physiology; yet it is desirable to draw attention to points of special importance from a *clinical* aspect. At the end of the book, a number of stereoscopic plates are given, forming a series of illustrations which yield a view of the anatomical preparations precisely as though they were actually placed before the reader in the best position for observing the features to be noted. As the parts presented are described with each plate it is only necessary here to refer to them very briefly.*

THE NOSE.

In *Plate I (frontispiece)*, from a dissection in the museum of the University of Bristol, the anatomical relations of the whole upper respiratory tract are well shown.

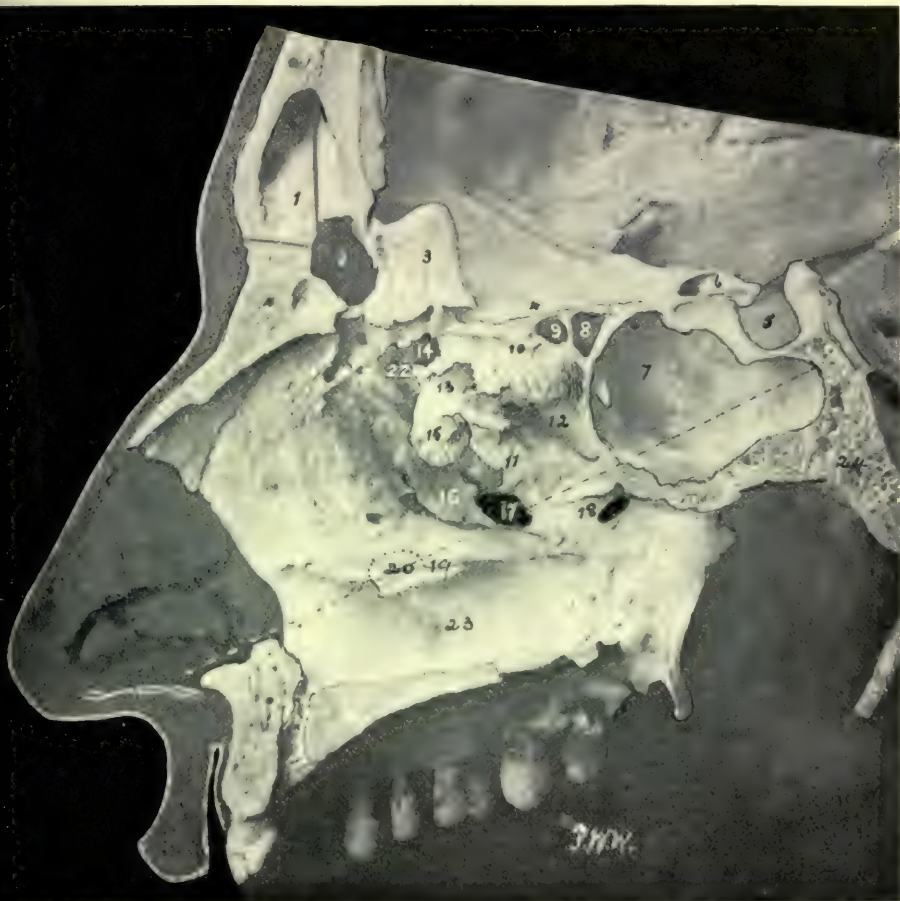
The nasal cavity is divided into two parts by the *septum*. To show the structure of the nasal fossæ I have cut three sides of the septum, and raised it as a lid, and have passed bristles through the openings in the walls of the fossæ by means of which the accessory sinuses communicate with the nose.

The plates, being exact reproductions from nature, will afford precise information as to the relations of the different regions of the nose, pharynx, and larynx, and will be found very useful as an aid in performing various manipulations necessary for the diagnosis and treatment of disease of the nose and throat.

Plate III shows the osseous structures forming the outer wall of the nose; *Plate XXIV*, the outer wall, covered with mucous

PLATE III.

MESIAL SECTION OF A SKULL, SHOWING THE RIGHT NASAL ACCESSORY SINUSES.



(1) Frontal sinus of the left side, separated by oblique mesial septum from (2) The right frontal sinus; (3) Crista galli; (4) Cribriform Plate; (5) Sella turcica; (6) Optic foramen; (7) Sphenoidal sinus; (8, 9) Posterior ethmoidal cells; (11) Remains of the middle turbinal bone; (13, 14) Anterior ethmoidal cells; (15) Bulla ethmoidalis; (16) Processus unciniformis; (17) Opening into the maxillary antrum; (19) Remains of the inferior turbinal bone; (20) Position of the opening of the nasal duct in the inferior meatus; (22) Fronto-nasal duct; (23) Inferior meatus. The dotted line is drawn from the nasal orifice to the posterior wall of the sphenoidal sinus.

N.B.—This preparation is displayed in stereoscopic relief in Plate XXV at the end of the book.

membrane. *Plate XXVII*, a vertical transverse section, should also be turned to ; it shows in section the position and shape of the turbinal bodies, and the narrow thin roof of the nasal cavity formed by the cribriform plate. The nasal cavity has an inner and outer wall, a floor, and a roof.

The roof is highest in the centre, where it is also narrowest, being formed by the cribriform plate, and only two or three millimetres wide. In front it is formed by the frontal and nasal bones, and behind by the body of the sphenoid. The floor varies in width from 12 to 15 mm. ($\frac{1}{2}$ to $\frac{3}{8}$ of an inch). The inner wall is formed by the septum.

The outer wall is somewhat complicated, but is very important from a clinical standpoint, and therefore merits fuller consideration. It presents three transversely projecting shelf-like bodies, the superior middle, and inferior turbinated bodies ; the long irregular longitudinal passages beneath them being the superior, middle, and inferior meatuses, in each of which are the openings of the accessory nasal sinuses. A fourth turbinal body, the concha superior, or *concha Santoriniana*, is sometimes present above the superior turbinated body. Zückerkandl found it in fifty-five out of one hundred and fifty specimens. The orifice of the sphenoidal sinus on each side is in the sphenothmoidal recess posteriorly, a few millimetres below the roof, and the openings of the posterior ethmoidal cells are seen in the superior meatus. In the middle meatus is a crescentic groove, the *hiatus semilunaris*, into which the frontal sinus opens anteriorly ; the orifices of the anterior ethmoidal cells and the frontal sinus generally open into the infundibulum. In the posterior portion of the hiatus semilunaris is the orifice of the maxillary sinus, the *ostium maxillare*. Sometimes the frontal sinus opens directly into the maxillary sinus, or both the frontal sinus and its duct may be absent. The anterior ethmoidal cells also sometimes open into the maxillary sinus. There may be a second opening to the maxillary sinus in the middle meatus, behind the hiatus semilunaris, the *ostium maxillare accessorium* ; or, on the other hand, a maxillary opening directly into the nasal passage may not exist.

The lacrymal or nasal duct opens into the inferior meatus, the opening being generally as far back as the second bicuspid tooth. A comparison between the sizes of these apertures in the skeleton and when covered by mucous membrane shows how greatly they are narrowed or even almost closed by the thick mucous membrane during life.

The Mucous Membrane of the nasal fossæ is called the Schneiderian, or, from the nature of its secretion, pituitary membrane. It is continuous with the skin through the anterior nares, with the mucous membrane of the pharynx posteriorly, and with the lining of the accessory sinuses of the nose, also through the nasal duct with the conjunctiva, and posteriorly by the Eustachian tube with the middle ear. It contains very numerous mucous glands, but these are most abundant at the middle and back parts of the outer wall and septum. The physiological functions of the nose are three-fold: vocal, olfactory, and respiratory, and the epithelium varies in character in different parts of the nasal passages, according to the different functions of these parts. Thus in the vestibule near the orifice of the nose, where common sensation is required, squamous epithelium is found; in the olfactory region, where the terminal filaments from the olfactory bulb are distributed (*see Plate XXXII*) the epithelium is columnar and non-ciliated and is pigmented, and lying beneath it are the olfactory cells of Max Schultze, but with these restrictions the whole of the nasal epithelium is ciliated.

The Arteries of the Nasal Fossæ.—The most important is the sphenopalatine, from the internal maxillary which passes into the cavity of the nose, through the sphenopalatine foramen at the back part of the superior meatus. Here it divides into an internal branch to the septum, the nasopalatine, and external branches supplied to the lateral wall of the nose, the maxillary antrum, and the ethmoidal and sphenoidal sinuses. In passing from the sphenopalatine foramen to the septum the nasopalatine artery crosses in front of the body of the sphenoid only a few millimetres below the aperture of the sphenoidal sinus, and is therefore liable to be injured in opening the sphenoidal sinuses. It runs along the side of the septum to end near the anterior inferior border of the quadrilateral cartilage, and is sometimes termed Kissenbach's artery. The other arteries are the alveolar branch of the internal maxillary to the antrum; the anterior and posterior ethmoidal to the roof of the nose, and the ethmoidal and frontal cells; and a twig of the small meningeal.

The Veins, after forming a close network beneath the mucous membrane, especially in the turbinal bodies, pass out with the sphenopalatine and ethmoidal arteries, but some, through the alveolar branch, join the facial vein, and others, it is important to note, communicate with the veins in the interior of the skull through the cribriform plate, and sometimes, especially in children, through

the foramen cæcum. Such intercommunication between the veins (and accompanying lymphatics) of the nose and face, and of the nose and cerebral sinuses, explains the clinical association of intranasal disease with facial erysipelas, etc., and cerebral symptoms respectively.

PHYSIOLOGICAL FUNCTIONS.

The physiological functions of the nose are, as already stated, threefold: olfactory, respiratory, and vocal. The first named is sufficiently noticed in other parts of the book.

The Respiratory Functions comprise: (1) Reflex influence on respiratory nerve centres; and (2) Warming, (3) Moistening, (4) Purifying the inspired air.

1. Under normal conditions breathing is an involuntary act, for though it may be temporarily arrested or accelerated by an effort of the will, it is habitually maintained and regulated according to the degree of vensity of the blood by the respiratory centre in the medulla, and the activity of external respiration—*breathing*—depends on and corresponds with the activity of internal respiration—*tissue metabolism*—thus, if a child runs he breathes more rapidly.

But although the respiratory centre is largely automatic, its activity is influenced by afferent impulses, and therefore is to a certain extent a reflex centre. Thus we have evidence that the normal activity of the respiratory centre partly depends on impulses reaching it from the lung through the vagi, from the surface of the skin, and lastly, but not least, from the nasal and naso-pharyngeal passages through the fifth and glosso-pharyngeal nerves.

That stimulation of the upper part of the nasal passages influences respiration has been demonstrated experimentally by Spencer (*see* p. 36), while common experience tells us that irritation of the nasal passages by smelling salts influences respiration, and intense subjective sense of dyspnœa following the insertion of the finger in the naso-pharynx for the diagnosis of adenoids, is due to the same respiratory inhibitory impulse that sometimes causes a dangerous arrest of respiration during the operation for the removal of adenoids under anæsthesia. Thus in young growing children with adenoids in the naso-pharynx we find in the *absence of normal nasal respiratory stimuli* a cause for that deficient activity of the respiratory centres which results in infraclavicular flattening of the chest wall.

I should be sorry to under-estimate other factors which must be held accountable for the defective physiological activity of the

respiratory centres in children suffering from enlarged tonsils and adenoids, chief among which is a chronic sapræmia, causing tissue inactivity, and hence absence of the normal need for more rapid respiratory exchanges, but I am anxious to emphasise the physiological import of the nose in influencing respiratory activity, and the pernicious effect of the absence of nasal respiration, not alone from the commonly recognized results of unwarmed and unmoistened air reaching the lungs, but from the persistent abrogation of nasal respiratory stimulation. It is scarcely an exaggeration to say that children who persistently fail to duly expand their lungs, in other words, whose respiratory exchanges are subnormal, are underfed, for a due supply of inspired oxygen is essential for the utilization of food in the processes of "internal respiration."

Disappointing results may follow operative treatment in nasal obstruction, firstly, because the real cause of the obstruction has been overlooked (generally because intranasal obstruction has been wrongly diagnosed as adenoids); or, in the second place, because the original cause of defective nasal respiration having been removed, the necessary measures for re-establishing long-lost normal respiration are not applied.

Physiological functions do not always persist in their entirety under abnormal conditions; thus it is that pathological conditions in the nose, apart altogether from the mechanical obstruction which may or may not exist in any material degree, become associated with diminished demand for oxygen, and hence diminished respiratory exchange. "Forced" feeding increases nutrition, provided, of course, assimilation can be assured, and so, too, respiratory exercises properly applied improve deficient respiration and increase the physiological demand for a fuller respiratory exchange; and if anyone doubts the possibility of inducing a healthy "air-hunger" as well as a normal gastric appetite, let him meet some healthy patients fresh from a sanatorium for consumption.

2. While the superior half of the nasal fossæ is mainly concerned with the function of smelling, the mucous membrane of the middle and inferior turbinated bodies contains vascular erectile tissue, which warms and moistens the inspired air. In these regions it consists of connective tissue, the surface of which is covered with columnar ciliated epithelium, the deep portion forming the periosteum. Between these two layers are lymphoid tissue, an abundant supply of lymphatics, and numerous venous plexuses, into which the capillary vessels

freely open, as shown in the accompanying illustration of a section of a hypertrophied inferior turbinal removed by snaring.

Around the venous plexuses unstriated muscular tissue is distributed. When the plexuses are filled the turbinal bodies become turgid and swell considerably, but numerous elastic fibres in the deeper layers cause the tissue to collapse, unless actively distended by the peculiarly arranged vascular supply. Similar erectile tissue is found occupying the lower part of the septum opposite the anterior extremity of the middle turbinal body.

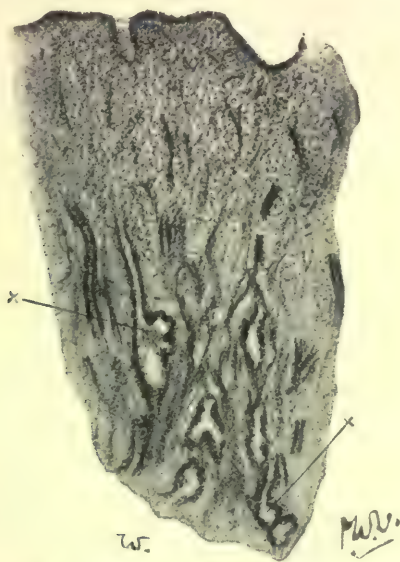


Fig. 13.—Section of hypertrophied erectile tissue from the inferior turbinated body; showing the arrangement of the vessels and venous spaces (X) into which the collecting veins are seen to open.

We know that "mouth-breathing" is not only a source of inconvenience, but is generally attended with troublesome affections of the lower respiratory tract. The nose therefore performs important functions which cannot be fulfilled by the mouth, and a careful examination of its structure affords a ready explanation of these functions: for it can easily be conceived that these highly vascular mucous tissues are capable of rapidly warming inspired air as it passes over them, and of secreting with equal rapidity a copious supply of

watery mucus which can yield its moisture to the warmed air. That this actually does take place has been demonstrated by Aschenbrandt, Kayser, Bloch, MacDonald, and others; and it has been proved by these observers that: (1) Whatever the temperature of the atmosphere, the air, after ordinary inspiration through the normal nasal passages, is raised nearly to the temperature of the blood before reaching the pharynx; (2) The air, after passing through the nose, is almost completely saturated with moisture.

3. It has been estimated that from a half to one pint of water is taken up by the inspired air in the course of twenty-four hours, and, if the air is to reach the lungs in the normal condition of saturation,



Fig. 14.—Diagram to show the normal path of inspired air through the nasal passages.

it is obviously impossible for that amount of moisture to be taken up from the bronchial mucous membrane without serious risk to its physiological integrity. We know that we can breathe normally all the night through, and awake in the morning with the pharynx and larynx in a moist and healthy condition; but if we have lain an hour or two breathing through the open mouth, the pharynx is quite dry, or is covered with a tenacious thick mucus, and if this mouth-breathing becomes a habit, the pharynx and larynx suffer from chronic congestion, and the parts are "relaxed." It is, in fact, unnecessary to dilate on the pernicious effects of mouth-breathing; the constant tendency to laryngitis, attacks of bronchitis, and various

other ways in which the evil effects are manifested are familiar to practitioners.

Course of the Air Current.—Investigations by Scheff, Kayser, Paulsen, and Parker have shown that the current of *inspired* air normally ascends in a curved direction from the vestibule into the middle and superior meatus, and thence gradually descends posteriorly to the choanæ. In expiration the current of air is very similar, but ascends more directly up into the olfactory region, thus aiding detection of flavours.

4. **Bacteriology of the normal Nasal Passages.**—It has been calculated by StClair Thomson and Hewlett that, at the lowest estimate, fifteen hundred organisms are inhaled into the nose every hour, while it must be a common event in the average London atmosphere for fourteen thousand to pass into the nose in a single hour. What becomes of them?

A further function, scarcely less important than those already mentioned, is subserved by nasal respiration, viz., the purification of the inspired air; and this is worthy of careful consideration.

It has been shown by the researches of several observers that expired air is practically germ free, and that all, or almost all, micro-organisms have been arrested in the nasal passages before the inspired air reaches the trachea; it was therefore, though erroneously, assumed that the nasal passages must be crowded with micro-organisms. For the most part the micro-organisms and various impurities are arrested in the vestibule by the vibrissæ, and those that pass this natural barrier during inspiration are rapidly removed from the nasal mucous membrane, partly by the downflow of mucus, and partly by the action of the ciliated epithelial covering.

Nevertheless there must be pathogenic organisms amongst those inhaled in any city atmosphere; hence we find that in any diphtheritic epidemic a large number of healthy children may yield diphtheria organisms on cultures being taken from the nose; and if, as has sometimes been done, these are considered to be infected with diphtheria on cultural evidence alone, quite uncalled-for alarm may arise and a number of healthy individuals be unnecessarily certified as suffering from diphtheria. So too with other organisms, such as the meningococcus, and could we as readily identify the organisms of scarlatina, and other common infectious diseases, we should doubtless find them in the noses of healthy individuals.

Any injury to the mucous membrane, either traumatic or

inflammatory, if it impairs the normal action of the surface ciliated epithelium is usually associated with septic secretion, then the impossibility of keeping the passages in an aseptic condition adds greatly to the difficulties attending operative measures.

Wurtz and Lermoyez found that as a rule the nasal mucus was sterile, and Thomson and Hewlett also made numerous cultures from the vestibule, the vibrissæ of the vestibule, and no less than seventy-six cultures from the interior of the nose; of the latter sixty-four remained absolutely sterile (84 %). But numerous colonies were generally obtained by cultures from the vestibule and vibrissæ. Thomson and Hewlett do not affirm that micro-organisms are completely absent from the Schneiderian membrane, but that under normal conditions they are quite exceptional. They have further shown that if a culture be deposited on the septum the organisms are rapidly removed by the action of the ciliated epithelium, and that in two hours none of the myriads of organisms could be detected by their bacteriological cultures. They further show that while nasal mucus is not germicidal, it exerts an inhibitory influence on the growth of micro-organisms.

Park and Wright have re-investigated these questions, making cultures from the mucus in the interior of the nose of thirty-six normal individuals, with the result that only six were sterile and thirty non-sterile; but in most of the latter the colonies were not numerous, and though these results demonstrate that the nasal fossæ are not sterile, they are not so rich in microbes as was formerly supposed *à priori*. They considered this to be due to the action of gravity causing a down-flow of mucus from the upper passages, to the action of cilia, to the fact that the mucus is not a good culture medium, to the filter action of the vibrissæ, and to the fact that inspired air usually contains few pathogenic micro-organisms. It is remarkable that many children with chronic membranous rhinitis which yields pure cultures of fully virulent diphtheria bacilli suffer from no constitutional symptoms whatever, while tubercle bacilli and various pyogenic cocci can rarely be found in the nasal passages of healthy individuals.

THE ACCESSORY SINUSES OF THE NOSE.

A fairly accurate knowledge of the anatomical conformation and relations of these accessory sinuses is essential in rhinology; and it is therefore necessary to refer somewhat fully to the numerous features of clinical importance which they severally present.

Note.—The student should read this section in connection with those on Diseases of the Accessory Sinuses, Sections XI and XII.

THE MAXILLARY SINUS (ANTRUM OF HIGHMORE).

(See *Stereoplates XX, XXI, XXVII, XXVIII, and XXIX.*)

The antrum is a three-sided pyramidal cavity hollowed out of the body of the superior maxillary bone; the base of the pyramid is the

PLATE IV.

SAGITTAL SECTION THROUGH THE LEFT NASAL PASSAGE, ETC.



Section showing the relations of the frontal sinus, ethmoidal cells, and sphenoidal sinus to the nasal passages. A window has been cut out of the middle turbinate body (10), to show the structures, etc., concealed by it and lying in the middle meatus.

- | | | |
|----------------------------|--------------------------------|----------------------|
| 1. R. frontal sinus | 7. 8. Posterior ethmoidal cell | 13. Middle meatus |
| 2. L. frontal sinus | 9. Ethmoidal bulla | 14. Inferior meatus |
| 3. Frontal lobe | 10. Middle turbinate body | 15. Sphenoidal sinus |
| 4. Anterior ethmoidal cell | 11. Middle meatus | 16. Eustachian tube |
| 5. Hiatus semilunaris | 12. Inferior turbinate body | 17. Optic tract |
| 6. Uncinate process | | 18. Hypophysis |

outer wall of the nasal fossa, the apex is the malar process. The *roof* is formed by the floor of the orbit, the floor by the hard palate and the alveolar process, the anterior wall by the facial and the posterior wall by the zygomatic surface of the superior maxillary bone.

Reference has already been made to the *aperture* of communication with the nasal passage beneath the middle turbinated body. In a number of subjects, about 10 per cent according to Zückerkandl, there is an accessory ostium in the mucous membrane closing in the large bony aperture; it is below the uncinate process of the ethmoid, behind the ostium, and uncovered by the middle turbinated bone. The clinical importance of this accessory ostium lies in the fact that an antrum containing pus may discharge its contents through an accessory ostium far back in the nose, and the pus will pass into the nasopharynx instead of forwards and into the middle meatus. The *floor* of the antrum is uneven from the projection of the sockets of the first and second molars, and several bony laminæ partially subdivide the cavity. These laminæ often interfere with drainage of pus from the antrum, and the position of the natural aperture shows that a collection of pus will escape more freely from the nose on lowering the head.

The relations of the posterior and anterior dental nerves, and of the superior maxillary nerve, which are well displayed in *Stereoplate XXXI*, explain the cause of direct and reflex pains in antral disease. If tumours grow in the antral cavity, or from other causes the walls of the antrum yield to distending pressure, the floor of the orbit is pushed up and displaces the eye, or the inner wall may bulge into the nasal passage, or the outer wall protrude outwards on the cheeks.

DEVELOPMENT.—The maxillary sinus varies considerably in size, not only in different individuals, and at different ages, but even on the two sides in the same individual. In some persons the antra are very small, in others they extend beneath the nasal fossæ above the hard palate. It is formed earlier than any of the other accessory sinuses of the nose, its development commencing about the fourth month of foetal life. The antrum is *small* at birth, and does not alter much in size until the second dentition, and then from about the sixth to the eighth year develops rapidly, but only attains its full dimensions in adult life. According to Turner the vertical diameter at birth is 3 mm.

THE ETHMOID CELLS.

The anatomical arrangement and relative development of the cells of the ethmoidal labyrinth, and their relationship to the frontal and sphenoidal sinuses, vary widely and with such frequency that it becomes impossible to draw definite lines between what is normal and what abnormal, but we may describe first the most constant as the typical conformation, indicating the commoner variations from this type, and finally illustrate unusual and hence abnormal developments.



Fig. 15.—Frontal section showing right side of nose. Cross section through ethmoidal labyrinth (SHAMBAUGH).

1, Meatus nasi communis; 2, Bulla ethmoidalis; 3, Processus uncinatus; 4, Concha media.

The subject is greatly simplified if we remember that developmentally the frontal sinus is only an anterior ethmoidal cell extending upwards into the frontal bone, and that similarly the sphenoidal sinus is a posterior ethmoidal cell extending into the body of the sphenoid; thus it is that both the frontal and sphenoidal sinuses may be encroached upon or even largely replaced by other anterior or posterior

PLATE V.

SAGITTAL SECTION SHOWING LEFT SIDE.



Preparation shows typical construction of ethmoid labyrinth; the several partition plates presenting an unusually simple form.

SHAMBAUGH.

1. Sphenoidal sinus
2. Plate of the concha suprema
3. Plate of the concha superior

4. Plate of concha media
5. Plate of bulla
6. Plate of processus uncinatus

ethmoidal cells respectively. Hence it is usual to differentiate the cells of the ethmoidal labyrinth into (a) Fronto-ethmoidal cells; (b) Anterior ethmoidal cells; (c) Posterior ethmoidal cells. It is also convenient to refer to the most posterior ethmoidal cells which are in direct anatomical relationship with, and often partly replace, the sphenoidal sinuses, as the *spheno-ethmoidal cells*.

Type conformation of Ethmoid Region.—If we examine a sagittal section (*Plate. V*), in which the middle turbinated body has been partially detached, we observe that the variable arrangement of the ethmoidal cells and their relationship to the other sinuses can best be illustrated by the scheme of Hajek, who showed that the ethmoid labyrinth consists of four basal plates or lamellæ with intervening grooves, viz.: (1) The *unciform plate*, made by the unciform process, separated by the *unciform groove* or hiatus semilunaris from (2) The plate of the ethmoid bulla, separated by the *ethmoid bulla groove* from (3) The plate of the middle turbinate (concha media), separated by a groove from (4) The lamella of the attachment of the superior turbinate (concha suprema).

Between each of these plates there is a groove, and these basal grooves or spaces are encroached on and partly obliterated in the adult by ethmoid cells, which develop in these bony plates, some draining into the middle meatus, the anterior ethmoid cells, and some into the superior meatus, the posterior ethmoid cells. We shall find that it is chiefly owing to the development of cells in any or all of these bony plates, and even in the middle turbinated body itself, that variations and irregularities arise.

Note that the line of attachment of the middle turbinate, i.e., the *incisura ethmoidalis superior*, divides the anterior from the posterior group of ethmoid cells. Leaving for the present the posterior group, we turn to the further consideration of the anterior group covered by the middle turbinated body. If we lift or resect this middle turbinated body, we find it forms the inner wall of a funnel-shaped cavity or space, termed the *infundibulum*, on the outer wall of which lies the ethmoid bulla, below and in front of which is the hiatus semilunaris or unciform groove, while behind the bulla is the less-marked groove of the bulla. The upper end of both these grooves usually end blindly. But, as Mosher, Heymann, and others have demonstrated, it is very common for the summit of the unciform groove to end in one or two ethmoid cells, and these cells are then in direct relation with the floor of the frontal sinus, and very often one

of these cells attains a considerable size, mounds into the floor of the sinus, and is called a frontal bulla. But the summit of the unciform groove, instead of ending blindly, may open into the frontal sinus.

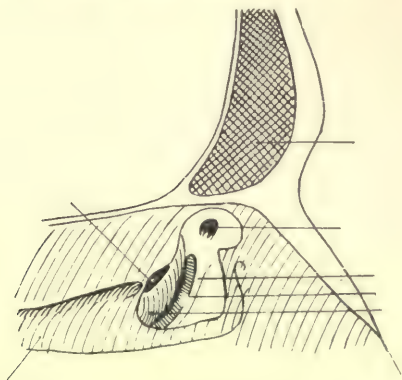


Fig. 16.—A window has been cut in the middle turbinal, exposing to view the infundibulum, which stretches upwards: the ostium frontale being seen on the lateral wall of the infundibulum. (The ostium may be in any part of the roof of the lateral wall.) The hiatus semilunaris ends blindly above (HEYMANN and RITTER).

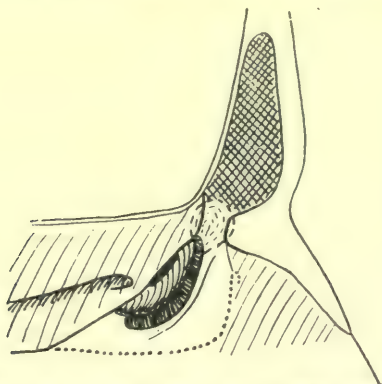


Fig. 17.—Terminal hiatus cell starting at the ostium frontale, which gets narrowed (on account of this cell) at the outer side, and forms in consequence a vertical slit (HEYMANN and RITTER).

The frontal sinus may rarely open instead into the summit of the groove of the bulla.

But in about 50 per cent of cases " the frontal sinus opens separately, above and internal to the unciform groove and in direct line

with it" (Mosher). This, which must be regarded as the normal opening of the frontal sinus, is a development of the *recessus*

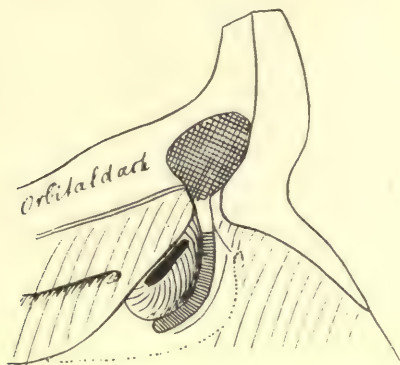


Fig. 18.—Opening of the ostium frontale and the hiatus semilunaris in the infundibulum. The latter, however, is so narrow and short that it only forms a narrow connecting space between the ostium frontale and the open superior end of the hiatus semilunaris. In this way the frontal cavity is apparently in direct connection with the superior end of the hiatus semilunaris (HEYMANN and RITTER).

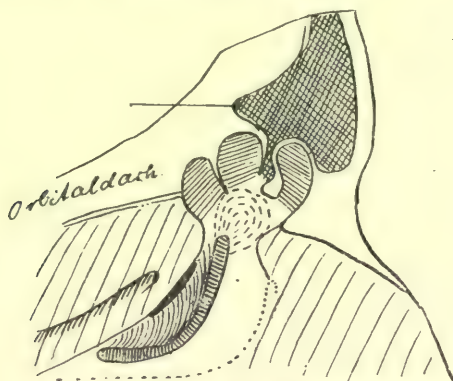


Fig. 19.—The infundibulum here is wide and reaches high up. There is a terminal hiatus cell. In the infundibulum, infundibula cells open. Between the two in front is a narrow ostium frontale. Owing to the marked development of the frontal cells upwards, the lower part of the frontal sinus is narrowed to a ductus naso-frontalis (HEYMANN and RITTER).

frontalis. The frontal sinus is developed by the extension of this ascending recess (the *recessus frontalis*) in the anterior portion of

the middle meatus, the cavity usually extending upwards between the plates of the frontal bone. By lateral excavations of the recessus frontalis the upper anterior ethmoidal cells are formed, and so these cells surround and open into the fronto-nasal canal. But, as we have described above, the frontal sinus may be formed in another manner, viz., by the pushing forward of one of the upper ethmoidal cells; or on the other hand the developmental process

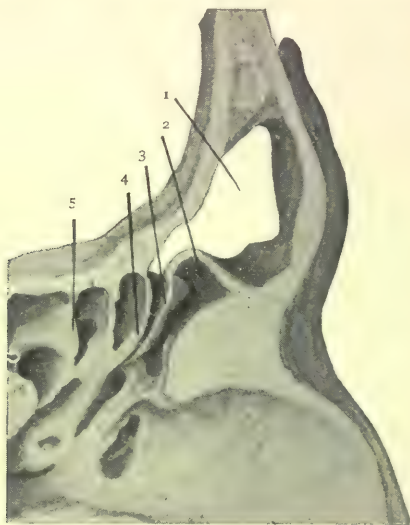


Fig. 20.—Sagittal section, showing left side. The preparation shows an ethmoid cell has been developed below the unciform plate, pushing this up into the frontal sinus, where a bulla frontalis is formed; the other plates of the ethmoid are formed as usual (SHAMBAUGH).

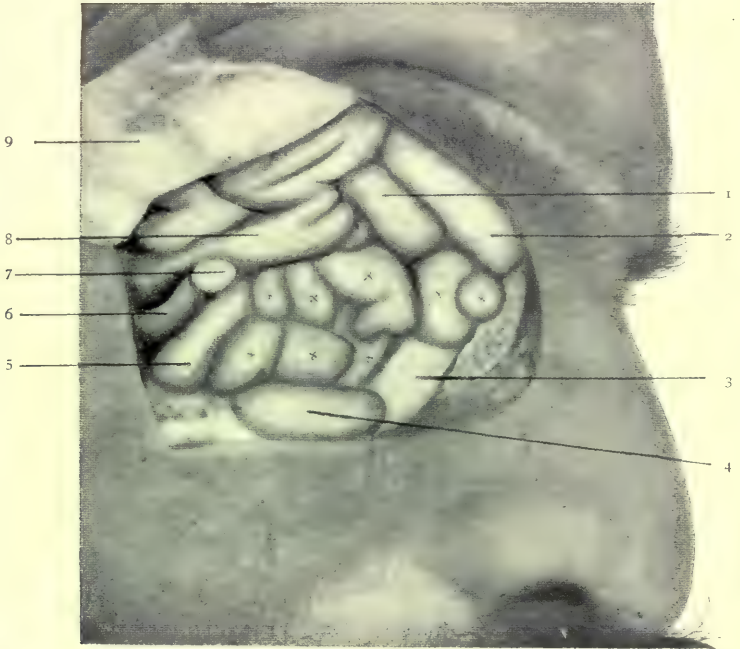
1, Sinus frontalis; 2, Bulla frontalis; 3, Plate of the unciform; 4, Plate of the bulla; 5, Plate of the concha media.

may stop short of the formation of a frontal sinus, or the frontal sinus may be present without any fronto-ethmoidal cells.

Just as the large cell at the summit of the unciform groove may bulge up into the floor of the frontal sinus, forming the frontal bulla, so may cells develop in the unciform lamella, a large cell there forming the cell of the agger nasi, either projecting up so as to mound into the floor of the frontal sinus, or backwards so as to encroach on and block the hiatus semilunaris or unciform groove. Not only do these

PLATE VI.

A HEAD WITH THE ORBITAL WALLS REMOVED.



The preparation shows the relations of the roof, inner wall and floor to the frontal lobe and optic nerve and the nasal accessory sinuses.

1. Recessus orbitalis
2. Frontal sinus
3. Nasal cavity
4. Maxillary sinus
5. Sphenoidal sinus

6. Internal carotid artery
7. Optic nerve
8. Frontal lobe
9. Dura mater
- x x x, Anterior and posterior ethmoidal cells

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ethmoidal cells mound into the floor of the frontal sinus, they often open into it. Into the lower part of the unciform groove is the opening of the maxillary antrum, while the small ostia of the anterior ethmoid cells surrounding the groove open into it along its course. It is these cells, distinguished as the "fronto-ethmoidal cells," which surround the passage leading from the frontal sinus down to the middle meatus, and form the fronto-nasal duct. If the cells are not developed the frontal sinus opens direct into the middle meatus.

Ethmoidal cells may be present in the anterior angle of the middle turbinated body (the operculum of Schwalbe). Lothrop found these cells present in 18 per cent of his specimens, some opening into the middle and some into the superior meatus. When the greater portion of the spongy bone is occupied by cells it is termed a *concha bullosa*. (See *Figs.* pp. 137, 138, and *Plate XXVIII.*)

The Posterior Ethmoidal Cells are a group of two or three large cells which open in the superior meatus close to the *recessus sphenoidalis*, or vertical groove between the ethmoid in front and the body of the sphenoid behind; their ostia are therefore just in front of the ostium sphenoidale. A posterior ethmoidal cell or cells may develop forwards so as to encroach on the frontal sinus, or come to lie between the orbital roof and the floor of the anterior cranial fossa (supra-orbital ethmoidal cells); or, again, an ethmoid cell may develop backwards so as to lie over the sphenoidal sinus, giving the condition sometimes described as double sphenoidal sinus.

The very important irregular, but by no means rare, relationship of the posterior ethmoid cell to the optic nerve is illustrated in *Plates VI to IX.* (See also pp. 205, 206).

DEVELOPMENT.—The formation of the ethmoidal labyrinth does not commence till the fourth or fifth year, and is not complete till about the age of twenty.

These ethmoidal cells are very irregular in their development, and I have found that very often they are developed inversely in proportion to the size of the sphenoidal sinuses, in the specimens in which the sinuses generally were fairly developed. A single posterior ethmoidal cell may be as large as a cherry.

THE FRONTAL SINUSES.

(*Plates VI, and XXI to XXVI.*)

The frontal sinuses must be regarded as an extension of the anterior ethmoid cells upwards, so as to lie normally between the inner and

outer tables of the skull, and thus not only in their development, but in their pathological states and the treatment to be employed for the relief of disease, we find that the frontal sinuses and ethmoidal cells are constantly closely associated. The origin of the frontal sinuses from the ethmoidal cells has already been described. The manner of the development varies greatly, as we have seen, but the degree of development and resulting size and situation of the frontal sinuses is equally variable; we will therefore describe first what must be considered as the normal type of sinus, and then point out the chief variations in their normal type which are of clinical importance.

The normal frontal sinuses are situated for the greater part in the frontal bone anterior to the ethmoidal notch.

The Anterior Wall is bounded below by the supra-orbital arch and the naso-frontal suture, but extends upwards a variable distance. The wall varies from $\frac{1}{3\frac{1}{2}}$ to $\frac{1}{2}$ an inch in thickness, averaging about $\frac{1}{8}$ of an inch. The surface is smooth, with minute foramina for venules leading to more or less cancellated tissue between the two layers of dense bone. An average of 200 sinuses gave a lateral width of from 2 to $2\frac{8}{10}$ centimetres from the middle line (Lothrop), that is, it extends laterally to the mid point of the orbital arch.

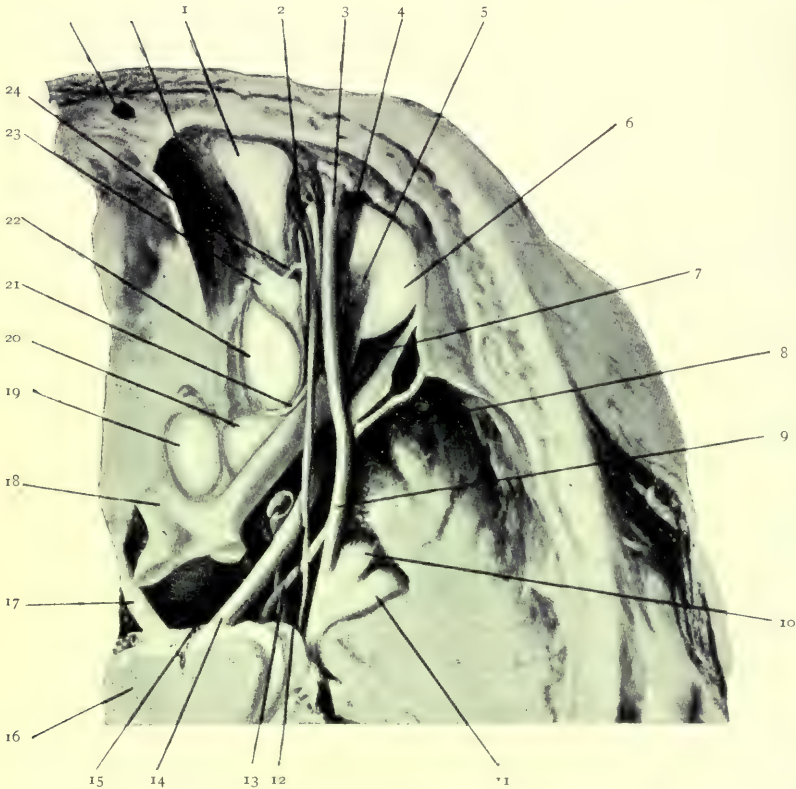
The Posterior Wall is about $\frac{1}{3\frac{1}{2}}$ of an inch thick, thin but dense, containing no diploe, and is in relation with the frontal and olfactory lobes of the cerebrum. It has a vertical and a horizontal part, and is strengthened by the partial septa which run more or less vertically, partly subdividing the sinus into a series of cavities. The horizontal part extends for a variable distance over the orbital fossa on either side, but towards the median line this wall extends back to the ethmoidal notch.

The Floor is partly above the orbit, the orbital portion; and partly above the nasal fossa, the nasal portion, in which is situated the ostium frontale leading to the naso-frontal duct, which is found in the posterior part and takes a direction downwards, inwards, and backwards to reach the middle meatus of the nose. The under-surface of this nasal part usually corresponds internally with the roof of the nose, while externally it overlies and completes anterior ethmoidal cells above the middle turbinal. As we have seen above, in a considerable number of cases one or more large anterior ethmoidal cells, or more correctly fronto-ethmoidal cells, form a conical projection in the postero-internal angle of the sinus, the *bulla frontalis*, and similar elevations may be



PLATE VII.

THE ANTERIOR FOSSA.



The roof of the right orbit of the corresponding nasal accessory sinuses has been removed so as to display the relations of the orbital contents beneath the roof with the ethmoidal cells, sphenoidal sinus, etc.

- | | |
|--------------------------------|------------------------------|
| 1. R. frontal sinus | 13. N. abducens |
| 2. Superior oblique muscle | 14. Oculomotor nerve, right |
| 3. Supra-orbital nerve | 15. Internal carotid artery |
| 4. Levator palpebrae muscle | 16. Pons |
| 5. Rectus superior muscle | 17. Oculomotor nerve, left |
| 6. Eyeball | 18. Optic nerve |
| 7. External rectus | 19. L. sphenoidal sinus |
| 8. Scala media | 20. R. sphenoidal sinus |
| 9. Trigeminal nerve, 1st div. | 21. Ethmoid nerve, posterior |
| 10. Trigeminal nerve, 2nd div. | 22. Posterior ethmoid cell |
| 11. Trigeminal nerve, 3rd div. | 23. Anterior ethmoid cell |
| 12. Trochlear nerve | 24. Ethmoid nerve, anterior |

produced by the upward projection of other anterior ethmoidal cells in the nasal portion of the floor, just external to the *ostium frontale*.

The sinuses are almost always completely separated by a bony septum, which is generally median below, but often deflected to one side or the other above. Although the plane of the septum is usually antero-posterior, it is sometimes so deviated that one sinus partly overlaps the other from before backwards, "even to the extent of 2 centimetres" (Lothrop). Once in 180 examples Lothrop found an



Fig. 21.—Diagram to illustrate the variable extent and development of frontal sinuses and the fronto-nasal communications.

oval perforation in the septum, and once the septum was almost entirely absent.

Communication between the frontal sinuses and the nasal passages exists in all cases, usually through the infundibulum, but (owing to the variations in the arrangement and development of the frontal sinus and anterior ethmoidal cells described above) one finds here important anatomical differences.

Irregularities and Variations.—The frontal sinuses vary in their size and development, and such variations have a very important bearing on operations here. In a developmental sense it is probably true that the frontal sinus is never absent, inasmuch as it is always represented in an undeveloped state by an ethmoidal cell. But for all practical purposes from the surgical standpoint, these miniature cells

are not frontal sinuses, and when a sinus does not reach to the vertical portion of the frontal bone, which is the case in 3 per cent of cases (Lothrop), it may be considered to be "absent." Logan Turner from an examination of 500 skulls, found that both sinuses were present in 357, or 71 per cent; both sinuses were absent in 80, or 16.1 per cent; and one sinus was absent in 63, or 12.5 per cent of skulls.

There are two distinct varieties of frontal sinus—the large, which has already been described as the normal, and the small.

The Small Sinus "does not rise above a line drawn between the two supra-orbital notches, while its anterior border is limited by a line running up from the crest of the lacrymal bone. When the cavity of the sinus is so reduced its anterior wall is very thick ($\frac{1}{4}$ to $\frac{1}{2}$ an inch thick)." (Mosher).

A large sinus may measure as much as 2 inches vertically, and may send a prolongation *outwards* over the supra-orbital ridge as far as or into the malar bone, or *backwards* over the orbital fossa and ethmoid cells and even the sphenoid sinus, so as even to extend into the lesser wings of the sphenoid. Other occasional prolongations to remember are: (a) Into the crista galli; and (b) Into the root of the nasal bone. Nor must we forget that upper anterior ethmoid cells may open directly into the floor of the frontal sinus, and participating in frontal sinus suppuration may reinfect such a sinus if in the course of operation the small apertures of these cells are not carefully noted and the suppurating focus cleared out.

There may be two sinuses, and both open together into one nasal passage only. I have observed one instance of this; another is recorded by Lothrop.

DEVELOPMENT.—Usually the frontal sinus is not present before the seventh year, but at puberty should be well developed, though it does not attain full development till the 21st year. The only certain means of ascertaining the existence, size, and form of the sinus during life, unless one opens into it, is by skiagrams. These should always be obtained before operating, if possible.

Lothrop in his 125 specimens found that (a) in 53% there was no fronto-nasal canal, the frontal sinus opening directly into the "turbinate fossa" in the middle meatus. In a few cases the frontal sinus opened into the middle meatus through an irregular series of ethmoidal cells; (b) An infundibulum was always present, the channel being partly bony, and a considerable portion membranous only. But in 53% of the specimens it had no connection with the frontal sinus, in these ending either (a) in a cell of large size often corresponding to the *agger nasi*, or (b) in one of the

PLATE VIII.

SAGITTAL SECTION OF A HEAD



Section showing the relations of the nasal accessory sinuses to the base of the brain, etc. (left side). Note especially that the optic canal traverses the sphenoidal sinus in this subject, so that rough instrumentation would involve risk of serious injury to the optic nerve, while suppuration in the sinus would probably lead to involvement of the optic nerve sheath. Observe, too, that the left frontal sinus extends well back, and that this left sinus is encroached on by that of the right side.

- | | |
|------------------------|-----------------------------|
| 1. L. OPTIC NERVE | 8. Inferior meatus |
| 2. R. frontal sinus | 9. Middle meatus |
| 3. R. ethmoid cell | 10. Superior meatus |
| 4. L. frontal sinus | 11. OPTIC CANAL |
| 5. Ant. ethmoidal cell | 12. L. sphenoidal sinus |
| 6. Ethmoid bulla | 13. Internal carotid artery |

ethmoidal cells in the posterior angle of the frontal sinus (*bullae frontales*), or (c) in very few instances, the infundibulum was blind in its upper end.

Furthermore, he found that while it was difficult to pass a probe upwards from the nose to the frontal sinus, it could always be passed downwards, inwards, and backwards, and that it could not do any serious injury if the probe was forced through any obstructing cell in this direction. But in nearly 50% of cases a straight probe passed from the frontal sinus in this way entered the antrum of Highmore, and in a large number of the other specimens a slightly curved probe could be made to enter the antrum. The importance of this observation is obvious, accounting for the frequency with which pus escaping from the frontal sinus enters the antrum.

Tilley, from an examination of 120 skulls, considers a sinus normal when it measures 28 millimetres from the median line outwards, i.e., about as far as the inner third of the supra-orbital ridge; and normal in vertical extent when it measures 20 to 22 millimetres.

THE SPHENOIDAL SINUSES.

(*Plates I, IV, VI, VII, IX, XXI, XXV.*)

The sphenoidal sinuses, like the other accessory sinuses, are very irregularly developed. They are situated in the body of the sphenoid, and may vary in development from entire absence, to a cavity which occupies the whole of the body of the sphenoid and extends posteriorly almost as far as the foramen magnum. The two cavities are generally separated by a bony septum, but are rarely of equal capacity, partly owing to the very frequent deviation of the septum, partly to the very unequal development of the sinuses on either side. I have once observed bony laminae partially subdividing one sinus.

I have seen a sphenoidal sinus, in a female aged 20, measuring $1\frac{1}{4}$ inches in length, the size of a pigeon's egg, having a capacity of 7.6 cc. This was a large central left sinus, the right sinus being very rudimentary. In one male the capacity of the two sinuses amounted to 10 cc.

The anatomical relations of the sinuses are of great clinical interest, and explain many of the symptoms that occur when the sinuses are the seat of purulent accumulations. Thus the roof from before backwards is in relation with the olfactory nerves lying in slight depressions, and the frontal lobes, the optic nerves, ophthalmic artery, and the optic chiasma lying in the optic groove, and still more posteriorly with the sella turcica. On either side the walls show an eminence corresponding to the carotid or cavernous groove in which lie the internal carotid artery and the cavernous sinus. The anterior surface

is formed by the thin sphenoidal turbinated bones which close the sinus on either side, leaving an oval aperture, the *ostium sphenoidale*, situated in the upper and outer angle one or two millimetres below the roof of the nasal fossa. Sometimes the sphenoidal sinuses open into the posterior ethmoidal cells instead. Zückerkandl has found in a few instances that a horizontal septum divides the sinuses into an

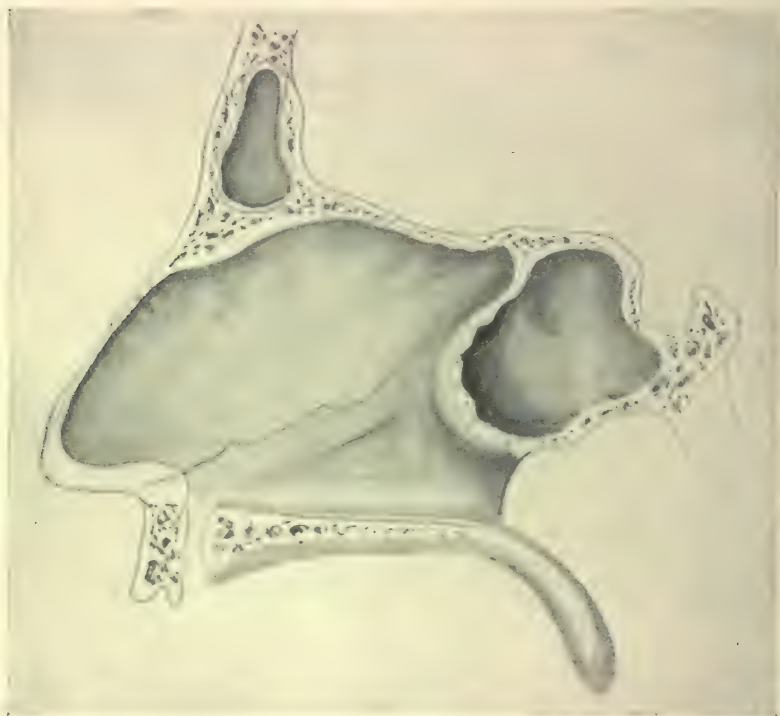


Fig. 22.—A left sphenoidal sinus extending forwards into the septum (plate of the ethmoid) (PARKER).

upper and lower one; the former, being in reality an extension backward of a posterior ethmoid cell, opens with the other ethmoidal cells, while the lower, or true sphenoidal sinus, opens into the nasal cavity in the usual place.

Traversing the anterior wall, in a groove near its lower border, is

PLATE IX.

LONGITUDINAL SECTIONS OF THE NOSE.

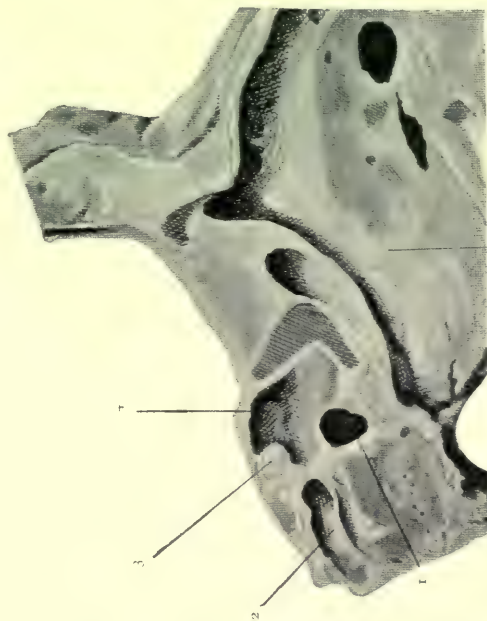


Fig. A.—Section to the right of the septum nasi, exposing the right sphenoidal sinus and posterior ethmoidal cell. Here the sphenoidal sinus is small and poorly developed, its normal position being occupied by a large posterior ethmoid cell: the optic canal traverses the posterior wall of the ethmoidal cell, while the internal carotid artery ascends behind this thin bony wall.

1. Sphenoidal sinus
2. Int. carotid
3. Optic nerve



Fig. B.—Section through the right nasal passages. An enormously developed posterior ethmoidal cell lies above the corresponding sphenoidal sinus, from which it is separated by a thin bony lamella, giving the condition sometimes erroneously described as double sphenoidal sinuses. The optic nerve is running along the upper and posterior wall of the ethmoidal cell.

6. Frontal sinus
7. Middle turbinal
8. Superior turbinal
9. Right post. ethmoidal cell
10. Right optic nerve
11. Right sphenoidal sinus

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the internal branch of the nasal or speno-palatine artery; it is therefore liable to injury in operating on the anterior wall of the sinus. Here, too, the speno-palatine nerve is situated, and may be irritated or compressed in sphenoidal sinusitis, thus explaining the reflex infra-orbital neuralgia and other reflected pains which may lead to an erroneous suspicion of antral or other sources of the pain. Very occasionally the sphenoidal sinus extends forward into the posterior portion of the septum nasi, the cavity lying between the two bony plates which by developmental apposition form the ethmoid plate.

DEVELOPMENT OF THE NOSE.

The diagrammatic sections of the head* in an early embryo show the three primary encephalic vesicles: (1) The anterior cerebral vesicle (thalamencephalon); (2) The mid-cerebral vesicle (corpora quadrigemina and peduncles of cerebrum); and (3) Posterior cerebral

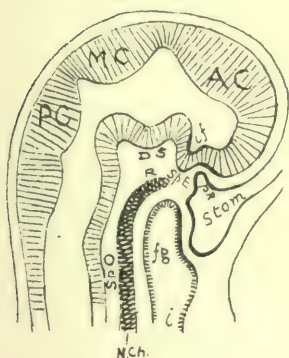


FIG. 23.

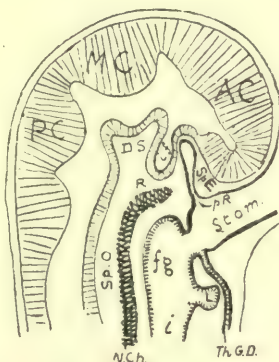


FIG. 24.

Stom., Stomodæum; *fg*, foregut; *P.R.*, pouch of Rathke; *if*, infundibulum; *Th.G.D.*, Thyroglossal duct. Other parts are described in the text.

vesicle (cerebellum and medulla). Between the anterior and middle cerebral vesicles is the first cephalic flexure (*DS*), corresponding in position to the sella turcica of the body of the sphenoid, marking the

* For the following description I am mainly indebted to the work of Prof. His.

division between the pre-sphenoid and post-sphenoid parts, the cavity in the primitive brain here representing the third ventricle. Below we see the anterior extremity of the notochord, embedded in the investing mass of Rathke (*R*). The latter forms the parachordal cartilage containing (*a*,) the post-sphenoid (*Sp.O.*), and (*b*,) pre-sphenoid (*Sp.E.*) developmental centres from which respectively, develop (*a*,) the bones of the cranial base as far forward as the sella turcica—that is to say, the speno-occipital portion of the basis cranii, and (*b*,) the pre-sphenoid or speno-ethmoid portion.

Primitive Mouth.—By an invagination of the epiblast the primitive mouth or stomodæum is formed which dips in until it meets the anterior end of the foregut (the future pharynx). By absorption of this partition the cavity of the mouth becomes continuous with that of the pharynx.

The Pouch of Rathke.—A diverticulum from the stomodæum of the embryo commences to form prior to the communication between the stomodæum and foregut, and soon passes up between the pre- and post-sphenoid developmental centres to the sella turcica (*Fig. 24; P.R.*). There it meets a similar pouch, the infundibulum (*if*) from the third ventricle of the brain, which comes to form the posterior lobe of the pituitary body, the anterior lobe being formed from the pharyngeal pouch just described.

The lower portion of the pouch of Rathke closes later in foetal life, but its position is marked in after life by the median furrow of the pharyngeal tonsil, the *recessus medius*, and sometimes a short tubular recess is left, the bursa pharyngea, or pharyngeal pouch. Thus the pouch or median recess is merely a pit or furrow in the rhino-pharyngeal tonsil, and has no clinical significance apart from that tonsil (see *Fig. 52, p. 90.*)

The pharyngeal tonsil is formed by invagination of the hypoblastic epithelium in longitudinal folds around the orifice of the pharyngeal pouch, lymph follicles being developed from the mesoblastic tissues between the epithelial invaginations. The pouch of Rathke develops in the front part of the stomodæum, and at birth its vestigial orifice, surrounded by the pharyngeal tonsil, has shifted its relations, coming to lie beneath the body of the sphenoid. After birth the tonsil continues to take a more posterior position. Killian observes that “the pharynx tonsil of man moves between the sixth month of embryonic life and end of the second decennium, from the baso-sphenoidal to the basi-occipital region.”

THE PRE-ORAL ARCHES.

The Face and Nose, above the mouth, are developed from the pre-oral plates, viz., on each side a median fronto-nasal, and a lateral maxillary plate. The median fronto-nasal plates extend downwards as far as the oral fissure, their lower ends dividing so as to surround the primitive nasal pits.

In negroes the nasal orifices remain widely separated, and the imperfect union of these plates in the middle line may cause in after life a depression, or a bifid tip to the nose (see *Fig. 26*).

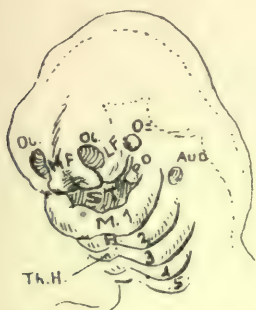


Fig. 25.—Diagram of the head of a fœtus, illustrating the formation of the external nose, the mouth, and the pre-oral and post-oral plates.

OL, Olfactory pits; *MF*, median-frontal, and *LF*, lateral frontal plates; *ST*, stomodæum; *M*, mandibular arch; *H*, hyoid arch; *Th.H*, thyro-hyoid arch, etc.

(From models in Wax by Ziegler in the Museum of the Bristol University College.)



Fig. 26.—Head of more developed fœtus, the nose still presenting the central depression and negro-type, while the remains of the hyoid fissure still persist.

Development of the Internal Nose.—We have already referred to the two developmental centres in the parachordal cartilages, the pre-sphenoid and the post-sphenoid. Cartilaginous trabeculæ from the pre-sphenoid centre on either side extend forwards, meeting in the median line to form the cartilaginous septum nasi and at their anterior extremity surrounding the nasal pits.

The imperfect union of these cartilages may result in a split septum in after life.

The nasal pits appear to form the vestibule, and are at first closed at the bottom by the layer of involuted epithelium. This epithelial septum disappears so as to form a free passage from the nasal orifices with the nasal fossæ.

If this septum is not absorbed completely, a partial or complete septum remains in after life at the back of the vestibule.

INNERVATION OF THE NOSE.

The nervous supply to the nasal passages is derived from the **olfactory nerve**; and the **trigeminus**, viz., nasal branch of the ophthalmic to the upper and anterior part of the outer wall and septum; filaments from the anterior dental branch of the superior maxillary to the inferior turbinal and meatus; the upper anterior nasal branches of the sphenopalatine (Meckel's) ganglion, and the Vidian nerve, supply the superior and middle turbinals, the intervening meatus, and

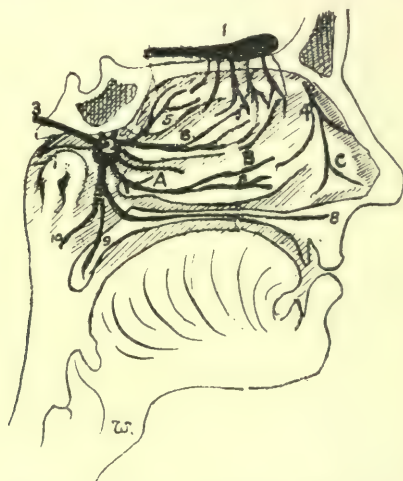


Fig. 27.—Diagram of the nerve-supply to the nasal passages.

1, Olfactory bulb with branches descending to the region of the superior and middle turbinated body; 2, sphenopalatine ganglion; 3, Vidian nerve; 4, external filament of the ethmoidal branch of the nasal nerve; 5 and 6, branches of the sphenopalatine ganglion to the superior and middle turbinated bodies; 7, branch of the anterior palatine to the inferior turbinated body; above it is seen the naso-palatine branch to the septum nasi; 8, anterior palatine nerve; 9, middle; and 10, posterior division of palatine nerve.

the upper and back part of the septum; the large anterior palatine nerve supplies the middle and lower turbinals and meatuses, and the naso-palatine supplies the middle of the septum.

All these nerves, as well as the sphenopalatine ganglion and the Vidian nerve, are shown in *Fig. 27*; see also *Plates XXI, XXXII*,

and XXXIII. We shall refer to them again in connection with nasal neuroses.

Various functions are subserved by the nerve supply to the nasal passage, *viz.* :—

(a) Olfaction by the filaments to the olfactory bulb, which pass through the cribriform plate from the olfactory cells of Max Schultze, from which the fine terminal filaments pass through the external limiting membrane of v. Brunn to lie between the columnar epithelial cells. The olfactory nerve fibres represent the axones of the olfactory cells, and are non-medullated. Von Brunn showed that the olfactory

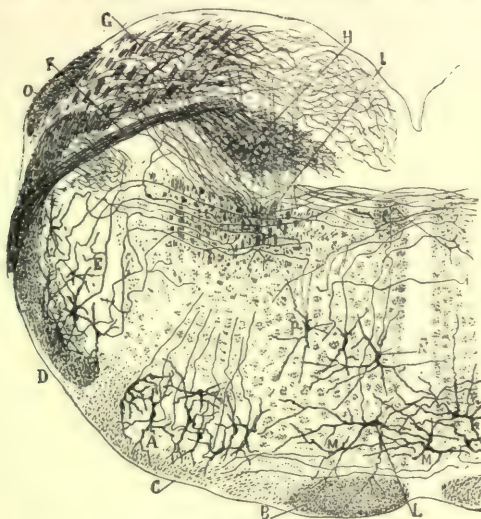


Fig. 28.—Transverse section through the bulb of a new-born mouse (CAJAL).

A, nucleus of the facial; B, pyramids; D, ascending root of fifth nerve; E, substantia gelatinosa; F, sensory root of the vagus and glossopharyngeal; G, descending root of the vestibular; H, sensory nucleus of the vagus and glossopharyngeal; I, lateral central tract of the vestibular, trigeminus, vagus, and glossopharyngeal.

area of the nasal mucous membrane is restricted to a small area covering the superior turbinal, the adjacent part of the septum and nasal roof, the whole area occupying about six square centimetres.

(b) Ordinary sensation by ethmoidal branches of the fifth nerve from Meckel's ganglion and the superior maxillary, etc.

(c) The arterial supply to the mucous membrane and to the erectile tissue of the turbinated bodies is controlled by vasomotor nerves from

Meckel's ganglion, and is under the control of the vasomotor centres in the medulla, where there is probably a connection with the nuclei of the vagus through association fibres, a physiological connection which has an important bearing on the pathology of various neuroses, as for instance the cases of asthma associated with nasal disease.

I would especially direct attention to Cajal's observation that a few of the collateral fibres from the gelatinous substance of Rolando, which is the receptive nucleus of the trigeminus in the medulla, break up under the motor nuclei of the facial and vagus, "and the inference is they communicate" (Golgi method). Also in the mouse Cajal figures collaterals from the sensory ganglia in the substance of Rolando: the descending root of the fifth nerve terminates by arborization in the substance of Rolando, and from the cells of the substance of Rolando axones arise which terminate in the nucleus ambiguus of the same side and in that of the opposite side.

As a further indication of the physiological association existing between the several portions of the respiratory tract, it is worthy of note that Spencer, corroborating and extending Munk's observations, has demonstrated experimentally the influence of the nasal area, and, in less degree, of excitation of other sensory areas, on normal respiration. He found that four different results were each obtainable from a distinct area on the cortex; all the results being such as can be produced upon respiration by means of the will: (a) *Slowing of respiration rate*, or arrest, was obtained from the frontal lobe, just outside the olfactory tract and along the olfactory limb of the anterior commissure; (b) *Acceleration of respiration rate*, from around the upper end of the infra-orbital sulcus; (c) *Snuffing*, from the mucous membrane of the nose in its upper part, from the olfactory nerves, bulb and tract, and uncinate convolution of the temporo-sphenoidal lobe; (d) The fourth effect which can be obtained from the surface of the cerebrum is a widely generalized one, because it can also be obtained from excitation of any sensory nerve. The chest assumes a position of *over-inspiration*.

SECTION III.

RHINITIS.

ACUTE AND CHRONIC CATARRHAL RHINITIS	NASAL DIPHThERIA
PURULENT RHINITIS	FIBRINOUS RHINITIS
CHRONIC RHINITIS	RHINITIS CASEOSA
HYPERTROPHIC AND ATROPHIC RHINITIS	XANTHOSIS
	FURUNCLE AND ABSCESS OF THE VESTIBULE

ACUTE AND CHRONIC CATARRHAL RHINITIS.

SIMPLE Acute Rhinitis, the common cold in the head, hardly requires lengthy notice here, except to emphasize the fact that it is due to micro-organisms affecting a susceptible mucous membrane, having an incubation period of about two days, and which, in individuals predisposed, acquire increased virulence. Thus it is we often find one weakly member of a family who is continually catching colds in the head and infecting the other less susceptible members in turn.

Chronic Catarrhal Rhinitis may result from frequently recurring attacks of acute rhinitis, which result in a certain degree of permanent thickening of the tissues and chronic congestion—a more or less persistent chronic rhinitis, with frequent slight or acute exacerbations. Chronic rhinitis is often left in children after measles or scarlet fever, it may be associated with more or less ill health, and is a condition which should not be neglected or treated too lightly, as it so often leads to complications of the middle ear. Similarly the strumous diathesis or the existence of post-nasal adenoids are common causes of chronic rhinitis and of ear disease. Doubtless many cases of otitis media in children could be prevented by timely treatment of chronic rhinitis.

Bacteriology.—Allen,* as the result of thirty cases of nasal

* "The Opsonic Method of Treatment," London, 1907, p. 116.

catarrh, acute and chronic, examined bacteriologically to determine the causative organisms, obtained results that he tabulates thus :—

	Bacillus of Friedlander	Bacillus Influenzæ	Bacillus Septus	Micrococcus Catarrhalis
Acute - -	Yes	Yes	Yes	Yes
Subacute - -	Yes	Rarely	Rarely	Yes
Chronic - -	Yes	No	No	No

and from a full examination of his findings concludes that “it would appear that the only common cause of non-suppurative chronic nasal catarrh is the bacillus of Friedlander.”

Symptoms.—It is unnecessary to describe the well-known symptoms of simple nasal catarrh, but it is well to remember always that acute rhinitis is a common symptom in the early stages of measles and influenza, and that the symptoms of vasomotor rhinitis, hay-fever, nasal polypus, etc., may very closely simulate a simple cold in the head. The mucopurulent discharge of the later stages of simple catarrh may, without due care, be mistaken for that of a true purulent rhinitis.

As the affection passes into the sub-acute and chronic phases the symptoms are mainly those of more or less mucopurulent nasal discharge, unless the nasal accessory sinuses have become so involved as to cause additional symptoms. A sense of discomfort and heaviness in the nose, or even a sense of weight and headache, may be sufficient to seriously inconvenience the patient.

Complications.—Even in simple nasal catarrh, and more frequently in influenzal, scarlatinal, and morbilliform rhinitis, the inflammation may spread to the nasal accessory sinuses, causing severe pain in the forehead, cheek, or in the nose, together with other indications of acute sinusitis, which is fully described in the section on “Accessory Sinus Disease.”

Treatment.—Practical experience has shown that it is possible to abort a cold if it be taken in time, and most of the remedies that have proved successful are local stimulants to the nasal and pharyngeal mucosa, or local germicides. For those who can take it there is no remedy which is so effectual in aborting an incipient catarrh as quinine in doses of 15 or 20 gr. during the first twenty-four hours. A hot water and mustard foot-bath, and the administration of 10 gr. of Dover’s powder, together with hot drinks on going to bed, is a popular

device which often proves successful. The nasal chambers should be sprayed with any of the alkaline antiseptic solutions, until they are sufficiently cleansed, and then the following solution used with a nasal atomizer :—

R	Eucalyptol	-	-	-	-	℥x
	Terebene	-	-	-	-	℥vj
	Menthol	-	-	-	-	gr. vi
	Camphor	-	-	-	-	gr. j
	Liquid Oil of Paraffin	-	-	-	-	to f 3ss.

Tilley recommends a fine spray of a solution of formalin ($\frac{1}{4}$ to $\frac{1}{2}$ per cent) *applied in the early stages*, but adds that “for about two minutes after its application the sensations of burning and stinging are intense, but these rapidly subside.” It is well, therefore, to use first a spray of weak cocaine solution.

Infants may be unable to take nourishment when the nose is blocked from catarrh, and to relieve the nasal obstruction a 2 per cent solution of cocaine, or a 1-10,000 solution of suprarenal extract, may be applied with a camel-hair brush to the nasal passages.

For the sticky mucopurulent discharge of chronic cases a coarse spray of some simple alkaline nose wash or nasal douche (see various formulæ in Appendix) is very beneficial.

Without venturing to express an opinion as to the value of this method of treatment for acute and chronic nasal catarrh, I think that vaccine therapy is well worthy of full and careful trial. Allen, speaking of the acute stage, says that “this part of an attack can be cut down to a duration of only two or three days by the injection of a suitable vaccine.”

Attention to the general health and general hygienic surroundings, exercise in the open air, and the daily use of the cold bath, or cold bathing, will do more than any local treatment towards rendering the patient more resistant and less liable to colds. Acute rhinitis may be simply the result of a chill, a vasomotor rhinitis, the symptoms of which come on in a few hours after exposure, and are followed by a simple catarrh which may pass off in a day or two, or may often be checked effectually by a Turkish bath, or a hot bath and a Dover powder on going to bed.

PURULENT RHINITIS.

The acute purulent rhinitis of infants, *rhinitis neonatorum*, is generally due to infection at birth by leucorrhœal or gonorrhœal

discharge in the maternal passages, and is therefore similar in source and character to purulent conjunctivitis. In other cases the nose becomes inoculated after birth.

A chronic purulent nasal discharge may have its source in adenoid growths, and the possibility of their being the essential factor should not be forgotten.

In such patients especially, a form of chronic purulent rhinitis is sometimes associated with the strumous diathesis, the mucosa being swollen, boggy, and bathed in thick, viscid mucopus.

The micro-organisms usually present are gonococci and the various pyococci. In one case a discharge of blue pus from the nose was due to the *B. pyocyaneus*.

Were it not that diphtheria, whatever its clinical symptoms may be in any given case, is regarded as a clinical entity, we should have to include diphtheria bacilli in the bacteriology of purulent rhinitis.

The pathological changes in the mucous membrane are similar to those observed in suppurative inflammations of other mucous membranes, but the thickening of the submucosa, firstly from hyperæmia, and secondly from cell proliferation, causes more or less pronounced nasal stenosis. Moreover, there is always a possibility of involvement of one or more of the accessory cavities of the nose giving rise to a train of fresh symptoms which are excluded from consideration here.

The persistence of the inflammatory affection may result in a chronic hypertrophic rhinitis, and it is possible that with subsequent resolution atrophic rhinitis may form a final stage in the course of events.

Diagnosis involves two main questions : (a) Does the pus really originate in the nasal passages, or in the accessory cavities ? (b) If from the nasal passages, is it primary or secondary to a growth, foreign body, or some infective disease ?

A purulent discharge from the nose may occur also in diphtheria, syphilis, tuberculosis, measles, small-pox, erysipelas, glanders, etc., of the nose. Hence it is especially important to seek for any evidence of diphtheritic infections in cases at all doubtful. Nasal diphtheria in infants is rare, but it may occur, and without producing any marked general disturbance of health. I have myself met with an instance of this truly latent yet virulent nasal diphtheria in a baby aged 6 months ; but rhinitis is far more commonly due to the acute specific infectious diseases. Foreign bodies, rhinoliths, new growths, etc., often

set up purulent rhinitis, but the discharge is then usually unilateral ; and a traumatic abscess of the septum, either unilateral or bilateral, may discharge pus.

Finally, the possibility of the discharge coming from one of the nasal accessory sinuses must always be borne in mind.

Another but rare cause of purulent nasal discharge in infants is acute osteomyelitis of the upper jaw (Schmiegelow). The eyelids become swollen and œdematous, and suggest gonorrhœal ophthalmia, but the swelling of the cheek, hard palate, and the falling out of dental buds, with alveolar pyorrhœa, should prevent mistakes in diagnosis.

Treatment of purulent rhinitis in infants may become an urgent matter, owing to the impossibility of their taking the breast so long as nasal respiration is interfered with. The nasal passages should be syringed frequently with some mild warm antiseptic lotion, and subsequently a 1 or 2 per cent solution of protargol in water and glycerin should be applied to the nasal passages by means of a small camel-hair brush. It may even be necessary to obtain temporary relief to the nasal obstruction for the purpose of feeding, by the use of a very weak solution of cocaine hydrochlorate, or of cocaine in liquid paraffin oil.

In other cases the special treatment will largely depend on the actual cause of the purulent discharge, but in most it is necessary to use some alkaline and antiseptic spray or douche, to clear away the crusts and masses of secretion. For this purpose one of the formulæ given at the end of the book may be employed.

CHRONIC RHINITIS.

Etiology.—Simple chronic rhinitis (as distinguished from infective rhinitis) may be caused by the constant inhalation of irritating particles of dust, for instance, in stone-working, mattress-making, and upholstery. There are, however, numerous less obvious causes of chronic rhinitis, such as dyspepsia, constipation, portal congestion, excessive use of alcohol, sexual excess, anæmia, and the gouty diathesis; in other words, almost all the causes of chronic pharyngitis are possible causes of chronic rhinitis. Functional disorders of the digestive tract are capable of producing vasomotor reflex irritation of the inferior turbinated bodies, as is evidenced during attacks of acute gastric or duodenal catarrh.

Rhinitis Sicca is a chronic rhinitis attended with deficient secretion, the mucus becoming inspissated and tenacious, or forming

simply dry crusts of mucus unattended with fœtor. It is found chiefly in anæmic girls, or as a manifestation of the gouty or rheumatic diathesis, or may be due to chronic alcoholism. It is often associated with pharyngitis and laryngitis sicca.

Symptoms.—The only marked symptom is constant nasal “stiffness,” with or without discharge; in elderly patients especially there may be simply a copious watery exudation. The nasal mucous membrane is sometimes congested, then the turgid turbinal bodies pit on being touched with a probe; conditions which should be regarded rather as a form of vasomotor rhinitis. When the nasal discharge is due to irritation of particles of dust, the discharge is usually mucopurulent, and strings of sticky mucus occupy the nasal passages.

General Treatment.—In dealing with the chronic forms of rhinitis, attention to the general health is, of course, essential to success. It is too often regarded as a purely local affection. Indigestion, a tendency to constipation or torpidity of liver, if present, should be treated. The possible existence of post-nasal adenoids should be borne in mind. Change of air or a voyage, outdoor exercise, avoidance of hot, overcrowded rooms and late hours, will often succeed when local treatment alone has failed; and when we remember that chronic rhinitis is often largely dependent on disturbance of the neuro-vascular mechanism, that it is sometimes almost a neurosis, the necessity for a generous tonic line of treatment is obvious. Massage and cold douching daily are most beneficial, and I may cite the case of a medical friend of mine who, having suffered from chronic rhinitis for years, and in whose case local treatment had been attended with no lasting improvement, underwent a course of Turkish baths and massage continued for several months in succession, and has remained perfectly free from his nasal trouble for many years. Many similar instances have occurred in my experience.

Beverley Robinson recommends a tablet containing gr. $\frac{1}{4}$ each of chloride of ammonium and powdered cubebs with some liquorice, together with codeine if there is much cough, taken every fifteen or thirty minutes, or every hour for some time.

Local Treatment.—In the earlier stages of chronic rhinitis, such general measures may be aided by mild local applications. Supra-renal capsule extract in the form of a spray or a powder mixed with boracic acid, and gum acacia, used as a snuff, will act as an admirable local astringent, but any preparation containing suprarenal extract

should be used with caution and very highly diluted, or the secondary reaction will only lead to aggravation of the chronic congestion. I have also found great benefit from liquid vaseline containing terebene ($\mathbb{M}\text{x}$ ad $\mathbb{Z}\text{j}$), eucalyptol ($\mathbb{M}\text{xv-xx}$ ad $\mathbb{Z}\text{j}$), with camphor (gr. i-ij ad $\mathbb{Z}\text{j}$) sprayed well into the nose with an oil atomizer. This should be done night and morning for some weeks. If crusts of dried secretion tend to collect in the passages, fresh peroxide of hydrogen or bicarbonate of soda and borax solution in warm water should be forcibly sprayed in for some minutes till they are loosened and can be cleared out, the oily solution being subsequently used with advantage. A post-nasal spray may be required to ensure thorough removal of all collections of inspissated secretions in the naso-pharynx.



Fig. 29.—Method of using the auto-insufflator.

As the condition improves, and the mucous membrane of the nose becomes more tolerant, a snuff composed of sodium chloride $\mathbb{Z}\text{ij}$, boracic acid $\mathbb{Z}\text{ss}$, ammonium chloride $\mathbb{Z}\text{ss}$, camphor gr. j, may be used twice daily in the place of the other local remedies.

These are the remedies I have found most generally useful, but many others are recommended by various authorities, such as solutions of zinc sulphate gr. ij, alum gr. iv to viij, zinc chloride gr. j, nitrate of silver, grs. ij to xv, or sodium benzoate gr. xxx to the ounce; tar water; insufflations containing nitrate of silver, tannic acid, iodol, sozoiolol, potassium sozoiololate, sanguinaria, etc.

CHRONIC HYPERTROPHIC RHINITIS.

Etiology.—This may be regarded as an advanced stage of simple chronic rhinitis, and may, therefore, be due to those conditions which lead to chronic rhinitis. The inferior turbinal bodies especially are enlarged from thickening of the whole mucous membrane coverings; the thickening being due to chronic vascular distension of the venous sinuses and to secondary œdema. "As the œdema increases, the glands and blood spaces are pushed further back and the surface of the turbinal tends to become crenated. This is due to the gland ducts taking down the mucous membrane at various spots," and causing the so-called mulberry hypertrophy of the posterior ends. Sometimes the posterior enlargement is due mainly to lymphoid hypertrophy. From the histological investigation of twenty cases, Wyatt Wingrave found almost invariably mucoid degeneration of the muscular walls of the venous sinuses, and he suggests that in the persistent distension of the sinuses which ensues we have the explanation of the general hyperplasia associated with "turbinal varix."

Symptoms.—The nasal obstruction resulting from the hypertrophy of the tissues, and the constant presence of thick tenacious mucus which passes into the naso-pharynx may lead to constant hawking. The symptoms are those of simple chronic rhinitis greatly intensified, the obstruction of the nasal passages being sometimes so considerable that the patient cannot blow his nose properly.

Reflex nasal neuroses occasionally arise, especially a persistent hard, spasmodic cough, analogous to that cough which is excited by the passage of the Eustachian catheter. The existence of hypertrophic rhinitis will sometimes increase a liability to asthma and hay-fever.

On examination of the nasal passages, we find a general thickening of the mucous membrane. Especially is this noticeable in regard to the lower turbinals; and the nasal passages are often greatly narrowed by hypertrophied inferior and middle turbinated bodies.

With the rhinoscopic mirror the inferior turbinals are seen to have become even more hypertrophied posteriorly, the pale greyish-white, mulberry-like extremities more or less blocking the choanæ (see *Plate II, Fig. 4*). Mucopurulent secretion is usually present, and if abundant may even have to be removed by a coarse alkaline spray, in order to see clearly the condition of the nasal structures. These hypertrophied turbinals do not collapse to the normal extent on applying cocaine or suprarenal extract, and thus we have a ready

means of distinguishing œdema and hyperplastic overgrowth from simple venous distension of these normally vascular structures.

There should be no difficulty in distinguishing the pale-grey fibrous-looking hypertrophied turbinal bodies from a mucous polypus, which is movable, soft, and semi-translucent. In addition to the abnormal conditions already mentioned, we very often find a narrowing of the nasal passages from a deviation of the septum, or a spur, or some other structural deformity which may cause even relatively slight hyperplastic changes in the nasal mucosa to impede nasal respiration.

Treatment.—Our aim should be to reduce the volume of the enlarged turbinates, and when we have to deal with a well-marked hypertrophic form of rhinitis, it is necessary to have recourse to operative measures, for it is hopeless to expect a reduction of the mass of hypertrophied tissue by other methods. By the application of a 10 to 20 per cent solution of cocaine, we not only render the parts insensitise, but are able to judge how much of the enlargement is due to fibroplastic new growth which requires removal, and we are then in a position to determine what line of treatment to adopt.

GALVANO-CAUTERIZATION.—

In many cases it suffices to make one deep linear cauterization along the whole length of the hypertrophied turbinal. Some operators prefer to burn with a fine-pointed cautery a long deep channel from before backwards beneath the surface of the mucous membrane, **Submucous Cauterization**, but the result is much the same. Two or three of these cautery incisions may be necessary to reduce the hypertrophy, and about one week should be allowed between each application. Such methods result in a linear fibrous cicatrix which binds down the superficial mucosa to the deeper tissues and periosteum.

Considerable harm may be done if due care and skill is lacking in this latter procedure, for if the septal mucosa is touched with the incandescent cautery, and even if its reflected heat scorches the septum, the bared surfaces of the septum and turbinal are prone to unite in the process of healing, and the passage is more or less occluded. In order to

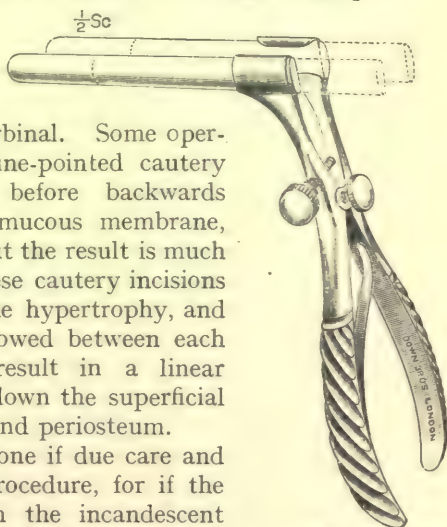


Fig. 30. — The author's adjustable long-bladed speculum.

avoid this unpleasant contingency it is safer to have the cautery points guarded on one side by a narrow ivory blade, or to use the author's adjustable ivory speculum with long blades, so arranged

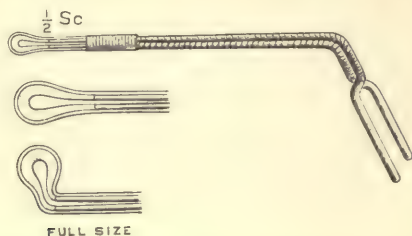


Fig. 31.—Guarded galvano-caustic burners.

that the outer blade is the usual length and the inner blade long enough to pass well beyond the posterior extremity of the cauterized line.

SUBMUCOUS INCISION, introduced by Delavan, has this advantage over the cautery, that it preserves the normal surface of the mucosa. For this purpose use a small knife, first applying cocaine in the usual manner, and then passing the blade under the mucosa, making a sweep through the submucous tissues, and then withdrawing it, care being taken to avoid any additional enlargement of the original opening. The instrument employed is like a long and narrow knife. It is better to repeat the operation than to overdo it. There is but

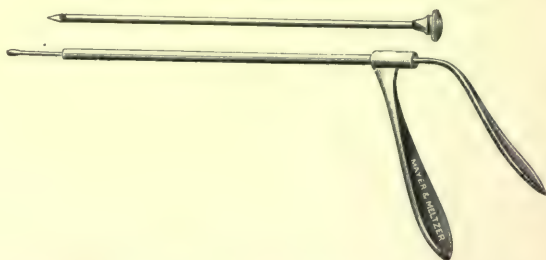


Fig. 32.—Goldstein's trocar and cannula applicator.

little pain, and only slight bleeding, which should not be checked, letting the slight hæmorrhage stop of its own accord. Delavan finds that this method is easy of execution and free from bad effects.

Stuart Low's submucous turbinectomy consists in making an incision down to the bone along the lower and anterior margin, reflecting the mucosa from the turbinated bone and then cutting away the exposed bone. The subsequent dressing keeps the two layers of mucosa in apposition till union takes place.

A combination of submucous incision and cauterization by chromic acid may be employed by Goldstein's method of introducing a long trocar and cannula, and then, after withdrawing the trocar, passing the probe with chromic acid fused on its end till it projected. The chromic acid was thus applied through the length of the channel as it was withdrawn. Care in the use of chromic acid is needed, and particularly is contraindicated in patients with damaged kidneys.

SNARING.—When the posterior hypertrophy of the inferior turbinal can be secured with a snare, it may be removed by this means. The

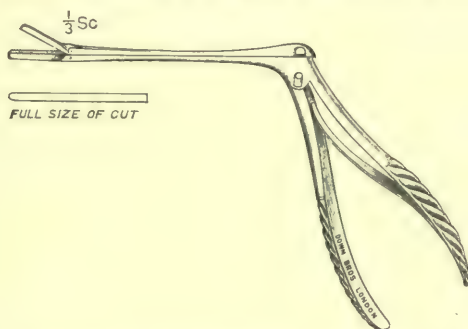


Fig. 33.—Struycken's narrow-bladed cutting forceps, useful in anterior turbinectomies.

result is highly satisfactory; and, though if the cold snare be very gradually tightened our object can be accomplished with little hæmorrhage, the galvano-caustic snare has one advantage in that it cuts through the tissues more rapidly. It is often extremely difficult to engage these masses of hypertrophied turbinal tissue, and in many cases it is necessary to first transfix the mass with a Jarvis needle, to prevent the wire of the snare slipping off as the loop is tightened.

RESECTION.—*Anterior middle turbinectomy*, or removal of the anterior end of the middle turbinated body, may be required, not only in cases where it is markedly hypertrophied, but even when

it is normal, in cases of frontal sinus disease, as it is very frequently impossible to catheterize the frontal sinus until the anterior end of the middle turbinal has been removed. This little operation may be done by cutting through the anterior half inch of the middle turbinal by means of special scissors or forceps bent at an angle, as shown in *Plate XV, Fig. A*, the end thus detached being snared off; or this part of the turbinal may be cut away with a narrow conchotome.

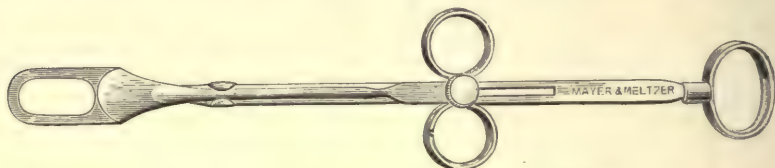


Fig. 34.—Lake's turbinotome, for posterior inferior turbinectomy.

Anterior inferior turbinectomy, or removal of the anterior third of the inferior turbinated body, may be accomplished in precisely the same manner, or with Ballenger's turbinotome.

In some cases simple removal of the enlarged anterior end suffices to afford free nasal respiration, but if the hypertrophy is very considerable and involves the whole or posterior parts of the turbinal, Lake's turbinotome, or long curved scissors, or Carmalt Jones' spokeshave, may be cautiously used to remove, not the whole turbinal, but as much as is abnormal in its dimensions. Ablation of the whole turbinated body has been followed by severe hæmorrhage,



Fig. 35.—Ballenger's swivel turbinotome for removal of the anterior portion of hypertrophied turbinals.

and as an after-result by collections of crusts in the nose, pharyngitis sicca, and laryngitis. Therefore, any operation involving resection of these important structures should be restricted to those cases in which less radical measures have failed, and only so much as is essential for the relief of nasal stenosis should be removed.

General Treatment is, however, quite as necessary in this affection as in simple chronic rhinitis, and all that has been said under this head

in reference to simple chronic rhinitis applies equally to the more advanced hypertrophic form, with this difference, that local treatment must occupy the first place in the latter disease, whereas it is comparatively unimportant compared with general therapeusis in the early simple rhinitis.

ATROPHIC RHINITIS.

Etiology and Pathology.—There is considerable diversity of opinion as to the pathology of atrophic rhinitis, and it must be confessed that the actual pathology of this common affection is at present an open question. Thus :—

1. Zaufal believes ozæna arises from a congenital deficiency of the turbinated bones resulting in undue patency of the nasal passages. It is difficult to accept such a view, for, though a disease of youth, it is never congenital, and, moreover, may undergo spontaneous cure.

2. The opposite view is held by Berliner, that it is associated with nasal obstruction, and due to pressure of the middle turbinal against the septum, with consequent defective secretion.

3. Habermann, extending B. Fränkel's and Krause's observations, regards ozæna as due to fatty degeneration of the acinous glands and Bowman's glands, with inflammation and fibroid degeneration of the mucous membrane, resulting in atrophy.

4. Michel, Grünwald, and others believe that accessory sinus disease, and Bosworth that purulent rhinitis of childhood, stand in causal relation to it.

5. The disease has been attributed to the action of many different micro-organisms. Vedova and Belfanti, in 120 cases, found the pseudo-diphtheria bacillus in all, and the *Bacillus mucosus* in many. The pseudo-diphtheria bacillus has been found in a great many cases by other observers, and in several cases the true diphtheria bacillus. By Fränkel and Löwenberg, a coccus and a little bacillus (Pes-Gradenigo) have been held to be the active causative agent. Not one of the above organisms has been accepted generally as the specific organism of ozæna, but Löwenberg, Abel (100 cases), and Cozzolino (42 cases), found the *Bacillus mucosus* present in every case examined. Cozzolino, in his 42 cases, found, in addition to the *B. mucosus*, the pseudo-diphtheria bacillus eight times, *Staphylococcus pyogenes aureus* and *albus* nine times and seven times respectively, and numerous other organisms in a varying proportion of the cases. He considers

that the *B. mucosus* is not the prime etiological factor in ozæna, but that it is responsible for the fœtor and formation of crusts.

6. It is often regarded as a final stage of chronic hypertrophic rhinitis. Undoubtedly this is occasionally true, but in the great majority of cases the disease is primarily atrophic, and has been known to arise in infancy.

7. In the writer's opinion the affection is a chronic inflammatory degeneration of the nasal mucous membrane due to infection by various organisms, and in some cases determined by conditions of the nature of a tropho-neurosis, which, like acne vulgaris, is often connected in some obscure manner with sexual development or sexual involution at the time of the menopause.

Ozæna is a clinical symptom which is almost invariably associated with atrophic rhinitis, and is probably due to some specific micro-organism, e.g., the *Bacillus fœtidus* (Hajek), and thus analogous to the peculiar odour of the secretion of the axillæ or feet.

Though ozæna may be present without atrophy, it is never so persistent and marked as in atrophic rhinitis. From its constituting the most prominent symptom complained of in most cases of atrophic rhinitis, the symptom has given the name to the disease; but we may have, though rarely, atrophic rhinitis without ozæna, or ozæna without atrophy, just as we meet with bronchiectasis which may not be "fœtid," and "fœtid" bronchitis without symptoms of bronchial dilatation. Moreover, the disease may be unilateral, and is often more pronounced on one side than the other.

Though heredity appears to have some influence, and it is often associated with anæmia and the strumous diathesis, ozæna is essentially a disease of puberty and young adult life, and the majority of cases are found in females.

Wyatt Wingrave directs attention to the remarkable atrophy of the lymphoid tissue in the nasal and naso-pharyngeal tissues, and in fifty-six out of sixty cases found complete atrophy of the faucial and pharyngeal tonsils. He has also demonstrated that the sticky secretions and crusts are not mucopus, for the elements of pus are wanting. The secretion is mucus with epithelial cells, multi-nucleated lymphocytes, with some staphylococci and other bacteria.

The disease does not appear to be infectious, though a few instances have arisen which lend support to such a view. Possibly the disease is a clinical rather than a pathological entity, and the symptoms may

occasionally be due to a communicable infection, thus differing from the great majority of cases.

Symptoms.—The patient usually complains of no pain, but of dryness of the nasal passages and naso-pharynx, alternating with profuse discharge when the masses of inspissated secretion come away ; but the characteristic and intensely foul odour is not perceived by the patient, who has generally more or less completely lost the sensation of smell. The nose is often flattened and broad, with sunken bridge. Pain at the back of the eyes, or over the bridge of the nose, is sometimes present.

On Inspection, the most noticeable features are the width of the nasal passages from atrophy of the mucous membrane, so that if the copious sticky secretion, which hangs in strings across the passages or collects in greenish-grey masses, is removed, we can often see the pharyngeal wall. Collections of dried secretion are found on the posterior pharyngeal wall, and on examining the larynx and trachea we often find them similarly affected, and that collections of dark green secretion occupy the trachea, the upper surface of the cords, or stretch across the glottis, causing more or less complete hoarseness or aphonia. The view that these are simply collections of inspissated secretion which have fallen into the glottis from the naso-pharynx, is probably incorrect. When the nose alone is affected, the breath from the mouth will not have the characteristic odour. The atrophic process may extend also to the Eustachian tubes.



Fig. 36.—Collections of greenish inspissated secretions in *Laryngotracheal Ozæna*.

The disease is a source of great annoyance, but is never fatal, nor does it involve any great danger to the general health. It tends to undergo spontaneous cure in many cases about middle life, and especially in women at the conclusion of the menopause.

Diagnosis.—The bony structures never become necrosed, and the absence of any dead bone or perforation of the bony septum are points which enable one to differentiate between true ozæna and tertiary syphilitic disease, attended with accumulation of *mucopurulent* secretion, and which often closely simulates ozæna in the intense sickly odour which accompanies this necrotic process.

The chief difficulty likely to arise is to distinguish from simple

true atrophic rhinitis the cases of sinus suppuration, especially of antral disease, which are associated with hardly distinguishable intranasal symptoms.

Atrophic rhinitis in infants and young children is rare, and the possibility of the affection being due to inherited syphilis should be remembered (see p. 61).

Treatment.—In this, as in all forms of rhinitis, a general tonic and hygienic treatment must be adopted whenever there is any indication of impaired health. But ozæna is very commonly associated with apparently good general health.

In the *local* treatment, which often at best is only palliative, the first essential point is the removal of the crusts of inspissated secretion. This, to be effectual, requires patience and care, but is readily accomplished by projecting a stream of a simple alkaline wash on to the



Fig. 37.—Boat-shaped nasal douche.

crusts at considerable pressure. The spray should be directed by the eye, with the nasal speculum *in situ*, and with the aid of a good illumination, and should be continued till every particle of secretion has been washed off. Large dry crusts may be gently removed by forceps, or by a probe covered with cotton wool. Similarly, the post-nasal douche must be used to get rid of all crusts in the nasopharynx. The best lotion to use is a simple alkaline antiseptic solution in warm water, such as Dobell's solution.

The patient must be directed to use an alkaline nasal douche night and morning, to prevent the accumulation of the sticky mucus and the formation of crusts. Warm water at 90° F., containing 1 or 2 per cent of bicarbonate of soda and common salt, answers admirably for cleansing.

A nasal syphon or simple hand-ball douche answers well, but the patient must be directed to use no force, to inject up the most blocked nostril, allowing the fluid to escape by the other side, and to be careful

to have the lotion at the proper temperature (about 95° F.). Without great care there is always a risk of setting up *otitis media* from fluid entering the Eustachian tube; hence the douche should only be ordered for cases like ozæna, and may be followed by a soothing, oily, antiseptic spray, or, as Christopher Heath recommends, a snuff composed of iodol and borax (1 to 7). Leffert's coarse nasal spray is very useful and sometimes more successful in removing crusts, while it is devoid of danger.

I have used, with some success, the daily insufflation of equal parts of citric acid and sugar of milk, as suggested by Hamm, the passage being first thoroughly cleansed by the douche; it seems to lessen the odour of the crusts.

The second point to consider is the best methods of increasing the functional activity of the atrophied mucous membrane. For this purpose nothing is more useful than Gottstein's method of using a strip of cyanide gauze about two inches wide, loosely rolled into a cylinder just large enough to be gently inserted into the nasal passage. It is sometimes more convenient for the patient to introduce a roll into one nostril at a time for twelve or more hours, and on its removal use a similar plug for the other nasal passage, and so on alternately. The secretions are rendered more watery, and the formation of foul smelling crusts is prevented.

Ionization or Cataphoresis.—The treatment of various affections of the upper respiratory tract by ionization, which, although not altogether new, has recently been employed with greater success owing to the improved technique, is as yet insufficiently established by experience wide enough to warrant definite statements as to its sphere of usefulness. Nevertheless, a method which has yielded excellent results in a limited number of cases, and more particularly in rodent ulcer, seems likely to prove of distinct value in certain diseases of the nose. The author has only employed ionization in atrophic rhinitis with a fair measure of success, though it is reported to have cured latent diphtheritic infections, and it may prove valuable in disinfecting mucous membranes infected with pyogenic and other organisms. For the nasal passages, metallic ions are mostly used, viz., copper, zinc, and magnesium. The author uses a thin, flat, polished metal electrode half an inch wide and about three inches long. Around this is wound a thin layer of absorbent wool, and this is introduced into the nasal passage after cocainization. The absorbent wool is soaked with a 1 to 4 per cent solution of a suitable salt corresponding

to the metal employed for the electrode, e.g., sulphate of copper, zinc, or magnesium. The intranasal electrode is always connected with the positive pole. The negative pole is placed under water in a basin, and in this the patient places one hand. The current is then gradually turned on till the milliampèremetre shows that 5, 10, or 15 ma. current is passing. The current should be continued for ten to thirty minutes.

The process may then be repeated on the other side, but it is usually better to defer treating the second nasal passage for a few days. Subsequent applications should be made about a fortnight later, and the ionization may have to be given several times before a beneficial result or a cure is brought about. It is possible that by packing an infected sinus with absorbent wool saturated with the metallic solution and connecting it to the metal electrode (the positive pole), the mucous membrane lining the cavity may be freed from pathogenic organisms.

Injections of Diphtheritic Antitoxin were introduced by Vedova and Belfanti on the assumption that the disease was due to the presence of attenuated diphtheria bacilli. In some cases temporary benefit is stated to have followed from these injections. I have tried it in a few cases only, but the result was absolutely *nil*. Possibly it is in cases where a true diphtheritic infection has preceded the development of ozæna, and in which the true pathogenic agent has been overlooked, that beneficial results have been observed. *Vaccine therapy* has yielded good results in some cases.

Galvano-cauterization of the nasal mucosa is generally to be deprecated, inasmuch as any destructive procedure, although yielding temporary benefit owing to the inflammatory reaction induced, is sure to increase the atrophic process.

Spraying or painting the nasal passages with stimulating **antiseptic solutions**, such as formalin, is sometimes attended with good results. Richards, after cleansing the passages and applying cocaine, sprays a solution of formalin containing 5 to 10 drops (of the 40 per cent solution) in 8 oz. of warm water; and one drop is added to the nose-wash, which the patient uses in the douche cup for the daily cleansing. In bad cases Bronner prescribes a 1-1000 to 1-2000 solution of the liquid formalin with water, to be used with a small nasal syringe; or a 1-500 to 1-1000 solution with a little glycerin added, to be used with a coarse spray three or four times daily for a few days, and then two or three days a week for a few weeks or months. If the application is painful the solution should be further diluted. My

experience of formalin solutions is that they are painful if strong enough to be effectual.

Lake has advocated injections of paraffin wax into the atrophied turbinals, so as to cause a narrowing of the wide nasal passages. In some patients the discomfort and accumulation of inspissated secretion appears to be lessened by this method.

Gendreau reports two cases cured by the condensation form of high-frequency currents. Twelve sittings were given. The small condenser electrode connected to a large Oudin's resonator was introduced for five minutes into each nasal passage (1 to 2 c.m. spark).

Operations on Accessory Sinuses.—The percentage of cases of ozæna associated with accessory sinus suppuration is a moot question, and authorities have differed widely in the results of their investigations, doubtless owing to some including under the term ozæna cases of accessory sinus disease which have caused some degree of atrophic rhinitis. True atrophic rhinitis is relatively seldom due to accessory sinus disease, but when clinical signs indicate that the maxillary antrum or any other sinus is involved, it should be opened and explored, and dealt with in accordance with the conditions revealed.

MEMBRANOUS RHINITIS.

(RHINAL DIPHTHERIA AND FIBRINOUS RHINITIS.)

Just as angina and laryngitis with membranous exudation are divided into two groups, the diphtheritic and non-diphtheritic, so must we separate into two classes cases of membranous or fibrinous rhinitis, viz., (1) rhinal diphtheria and (2) fibrinous or plastic rhinitis.

RHINAL DIPHTHERIA.

The essential pathology of rhinal diphtheria differs in no respect from diphtheria of the fauces, the presence of the Klebs-Loeffler bacillus differentiating this form of rhinitis from all others.

Symptoms.—Acute rhinal diphtheria is nearly always secondary to a throat affection, and in most patients extension of the disease from the pharynx is indicated by nasal obstruction and a copious discharge of acrid mucopus, sometimes streaked with blood or attended with epistaxis. The discharge is very irritating to the skin of the nasal orifice and upper lip, causing redness and excoriations around the anterior nares, on which false membrane may form.

It is an extremely fatal complication, perhaps owing to the fact that only very virulent Klebs-Loeffler bacilli will flourish in the nasal passages and produce marked symptoms, which may explain the usual gravity of nasal symptoms in diphtheria. It is well to remember that paresis of the soft palate causes an escape of fluid food by the nose, which might be mistaken for nasal discharge.

Primary Diphtherial Rhinitis is generally "latent" and unattended by any general symptoms, being a purely local affection characterized by the formation of false membrane in the nasal passages, and consequent nasal obstruction. Lambert Lack states that diphtheritic rhinitis (which he terms fibrinous rhinitis) is so common that the cases amounted to $2\frac{1}{2}$ per cent of all the children attending his hospital practice. The absence of marked constitutional disturbance is certainly not due to the diphtheria bacilli being non-virulent, for in a large proportion of cases the membrane yields a pure culture of typical long Klebs-Loeffler bacilli which prove highly virulent on inoculation of guinea-pigs, and in this fact lies the great danger of an apparently benign, purely local, nasal trouble, superficially resembling nasal catarrh, yet being the cause of diphtheria in those who are exposed to contagion. An instructive, but by no means isolated, instance in point occurred in Clifton, and is recorded in a report of the Medical Officer for Bristol, D. S. Davies : "A patient of a medical man suffered from an indefinite form of sore throat, and three weeks later the doctor's two children attended a party at the lady's house and were fondled by her. At intervals of eleven and sixteen days the children developed nasal membrane *without other disturbance of health*, and, portions of the membranes having been found by Dowson to contain the true bacillus, material was also submitted to Klein, who also found the disease to be diphtheria of a virulent type when tested by inoculation of guinea-pigs. Active local antiseptic treatment had been employed for some two months, when the children were declared practically free from the disease. But at the end of other two months their mother sickened with a disease which also proved to be true diphtheria, and the bacillus was again recovered from the children's nasal membrane. The malady in the mother ran a mild course, and at the end of another month no bacilli could be recovered from any one of the three patients."

Another variety of diphtheria is the external diphtheritic rhinitis described by Todd as occurring in children convalescent from scarlatina. The first sign is the appearance of a slight redness at

the posterior margin of one or both nostrils. The redness becomes more intense, and ultimately a moist granular-looking raw surface results. Todd summarizes his observations thus: (1) Children convalescent from scarlet fever in hospital are very liable to a certain form of external rhinitis, often accompanied by the formation of secondary pustules on various parts of the body; (2) This rhinitis, though not membranous, is associated with the presence of the Klebs-Loeffler bacillus in the nostrils, this organism being absent from the fauces; (3) It is contagious as such, but has not been observed to give rise to faucial or laryngeal diphtheria; (4) It is unaccompanied by rise of temperature, albuminuria, or marked glandular enlargement; (5) It appears to be limited to children under thirteen years of age, and has been most frequently observed at the ages of three and four years. The fact that the bacillus, though present in the nostrils in large numbers and causing a local lesion, does not give rise to any constitutional symptoms or to faucial or laryngeal diphtheria, suggests that its virulence is modified to a remarkable extent.

Treatment.—It is unnecessary here to discuss the general treatment of diphtheria, which is of course called for in true nasal diphtheria. Locally in nasal diphtheria a warm solution of salt in water (3j to the pint), followed by perchloride of mercury solution (1-3000 to 4000) should be used three or four times daily with the patient lying on one side. The nozzle of the douche is gently placed in the nostril and the stream allowed to flow in slowly, returning by the other nostril.

Latent diphtheria is apt to cause much trouble, not so much in relieving the patients' symptoms as in rendering them safe to mix with other people.

In obstinate cases *vaccine treatment* may be given, from twenty to fifty million organisms sterilized being injected every two weeks, beginning with the smaller doses.

If the areas infected are localized and accessible, *cupric or zinc ionization* may be tried (see "Ionization," p. 53).

FIBRINOUS OR CROUPOUS RHINITIS.

(NON-DIPHTHERITIC MEMBRANOUS RHINITIS.)

Definition.—Fibrinous rhinitis, first described by Schüller, is an acute or chronic inflammation of the nasal mucous membrane

characterized by the presence of false membrane, and due to the presence of the *Staphylococcus pyogenes aureus* or *Streptococcus pyogenes*, and though clinically these cases may be indistinguishable from the others, we are bound to separate them from diphtheritic rhinitis into a special class for the reasons already mentioned.

True (non-diphtheritic) fibrinous rhinitis is certainly less common than diphtheritic rhinitis. The Klebs-Loeffler bacillus was found in no less than sixty-nine of Wishart's ninety-eight collected cases. The only means of distinguishing the affections is by bacteriological examination.

Symptoms.—Generally the only notable symptom is mucous discharge and obstruction of the nasal passage by false membrane of greyish-white colour, there being no false membrane in the fauces; the glands of the neck are not enlarged, the urine is non-albuminous, and there are no paralytic sequelæ. Sometimes the attack is ushered in with chilliness and rise of temperature.

The affection tends to be protracted, and the membrane re-forms several times after removal.

Burn Murdoch has reported a case in which the attacks recurred six times, at intervals varying from one month to a year, each attack lasting about a week or a fortnight. The first attack began in November with symptoms of an ordinary cold. In a few days the nose was completely blocked: there was a copious muco-gelatinous secretion, and numerous fibrinous casts were shed, the nose and face being much swollen and painful, but in this case there was no rise of temperature. The subsequent attacks varied in severity. There were no paralytic sequelæ. W. F. Robertson's examination of the membranous casts of this unique case showed that they were composed mainly of fibrin containing numerous round cells. There were some epithelial cells suggesting shedding of the whole depth of mucous membrane. Sections stained by Loeffler's method showed no micro-organisms, and Gram's method only revealed a few groups of micrococci.

The majority of cases of so-called fibrinous rhinitis are really diphtheria, and cultures should invariably be made in order to avoid mistakes in diagnosis. If bacteriological investigation excludes diphtheria the diagnosis presents no difficulty.

Treatment consists in treating the general symptoms and improving the general health, and locally in the removal of the false membrane by forceps, and applying simple astringent and antiseptic aqueous solutions.

RHINITIS CASEOSA.

Rhinitis caseosa (*coryza caseosa*), originally described by Duplay, consists in a blocking of the upper regions of the nasal fossæ with caseous matter similar to that found in some sebaceous cysts. The affection appears to be always unilateral, and the diagnosis depends on the presence of the foul caseating matter in the middle meatus or olfactory fissure. The cheesy matter, which has an intensely foul odour, may form in considerable quantity, but as it sometimes causes obstructive anosmia, the patient may be unaware of any unpleasant smell. In one case under my care the condition was found accidentally, the patient not complaining of anything connected with the nose. The collection may be so considerable as to cause external deformity of the nose on the affected side. In several cases the antrum or some other accessory sinus has been implicated, and it is probable that some cases at any rate are due to a collection of inspissated pus in one of the accessory cavities finding an exit into the middle meatus or olfactory fissure. Massei expresses his conviction that caseous rhinitis is produced by the *Streptothrix alba*, which Guarnania has several times identified in true cases of caseous rhinitis.

The mucous membrane in the neighbourhood of the cheesy mass may become highly vascular, bleeding readily on the merest touch with a probe.

Treatment consists in the removal of the mass, thorough cleaning of the region involved, and the usual treatment of any accessory sinus that may be involved.

XANTHOSIS.

A dark yellowish pigmentation of the pituitary membrane, a result of interstitial capillary hæmorrhage into the mucosa, has been described by Zückerkandl under the term *Xanthosis*. It occurs either diffused over a considerable area, or in patches, especially in the anterior or cartilaginous portion of the nasal passages.

The affected mucous membrane is often more or less atrophied, and the cartilaginous septum may become the seat of ulceration or perforation as a consequence of the impaired nutrition of the mucosa.

When an ulcer forms it should be treated by applications of protargol or some other suitable germicide, so as to obviate the ulceration spreading or going on to septal perforation.

FURUNCLE AND ABSCESS OF THE VESTIBULE.

Furunculosis of the vestibule is relatively common, resulting from infection of the hair follicles. The site of the furuncle is often out of sight, and inasmuch as external and painful swelling and redness of the nasal ala is the most obvious feature, the true source of the trouble is liable to escape detection. When the small abscess forms it points inside the vestibule. In the earlier stages I have found that ammoniated mercurial ointment, with or without benzoated zinc ointment, will often cut short the trouble ; but when an abscess has formed it should be incised.

A suppurating dentigerous cyst may form a swelling in the lower part of the vestibule, and require incision.

SECTION IV.

CHRONIC INFECTIVE DISEASES OF THE NOSE.

SYPHILIS
TUBERCULOSIS
LUPUS

GLANDERS
SCLEROMA
HENPUYE

SYPHILIS OF THE NOSE.

INHERITED SYPHILIS.

THE Early Form occurs within the first three months of life, and assumes the form of a catarrh with tumefactions of the nasal mucosa, with consequent "snuffles." Norval Pierce observes that syphilitic coryza differs from simple coryza in the infant in that the onset is less violent, is more gradual, and the secretion, especially in the first stage, is not so profuse, but when established lasts longer, and that disseminated patches of well-defined erythema may be seen, especially on the septum, on which may develop plaques, the first pathognomonic signs of syphilis. The discharge of mucus or mucopus is irritating to the anterior nares, producing excoriations and fissures, and tending to form crusts in the nasal passages, which become somewhat foetid. Later characteristic flattening of the nasal bridge, resulting in a saddle-back depression, or "frog-nose," usually occurs: it is not due to loss of the septum, but is probably caused by mal-development from the effect of disease on the growing tissues, or to pathological changes in the periosteum. At this period necrosis of the cartilage is rare. When atrophic rhinitis attacks a child, and its bilateral appearance cannot be satisfactorily accounted for, the personal and family history should be investigated for indications of a congenital syphilitic taint, the ill-nourished, sallow appearance of the child being often enough to excite suspicions of the true nature of the disease.

The **Late Form** manifests itself between the age of five and puberty. It corresponds to the tertiary period in the acquired form, and is, therefore, characterized by gummy infiltration, caries, and necrosis of the cartilage of the septum, the vomer, and the turbinated bones, with foetid discharge and with consequent deformities.

ACQUIRED SYPHILIS.

Primary Sore is very rare. The most usual site is on the *alæ nasi*; less frequently it occurs just within the nasal passage beyond the vestibule. The chancre is generally due to inoculation with the finger nails, but kissing and other modes of infection are recorded. A small, round, hard, elevated, reddish papule first appears at the site of inoculation, gradually enlarging, till soon a central ulcer forms, which spreads outwards towards the slowly extending indurated margin. The floor of the ulcer is smooth, shallow, and covered with a thin glairy secretion. Thus the chancre does not differ in aspect from chancre elsewhere, but the secretion from the resulting catarrh is apt to collect and become inspissated. In young children the sore may appear as a simple papule without induration (Massei). In adults it is usually attended with induration and often with much swelling of the nasal mucosa, and feverishness. The submaxillary and sublingual glands, and those in front of the ear, usually show marked indolent swelling.

Secondary Syphilis gives rise to slight symptoms, chiefly nasal *catarrh* with tumefaction of the Schneiderian membrane, but the secretion becomes mucopurulent and sometimes sanious, and the epithelium degenerates and is to a considerable extent shed. *Mucous patches* may occur in the vestibule, or less frequently on the septum and inferior turbinated bodies, but they are much more rarely observed in the nose than in the mouth or pharynx. They are oval or round, slightly raised, and more like a bluish-red spreading papule than the mucous patches seen in the mouth. The patches tend to coalesce and to secrete freely and to undergo superficial ulceration, the ulcer being covered with whitish sticky pus and surrounded by a dark reddish-purple areola.

Tertiary Syphilis may assume the form of a localized gumma of the septum or turbinated bodies, a firm, circumscribed, red swelling. More generally we find extensive ulceration and suppuration, with caries or necrosis of the cartilaginous septum, the vomer, and the turbinated bodies. The discharge is considerable, purulent, bloody, yellowish-green, but is apt to collect and form foetid greyish-white or greenish-black crusts. If bony caries or necrosis has occurred—and it is but rarely that syphilitic ulceration is confined to the septal cartilage—the stench is indescribable, and most penetrating to those around, though to the patient the sense of smell is diminished or altogether lost: a probe will detect diseased bone concealed by the greenish necrotic tissue.

The disease is generally bilateral, though often more advanced on one side. Syphilitic infiltration of the cartilage and bone may result in: (1) Necrosis, with exfoliation; (2) Rarefying osteitis; or, (3) Formative osteitis with periosteal or perichondral thickening. Pieces of necrosed bone may be separated from time to time with the discharge, and in consequence of the contraction of the subcutaneous connective tissue, or from the partial or complete destruction of the nasal bones and septum, the nose becomes characteristically broad and sunken, "saddle-backed," or the whole of the cartilages and tissues of the alæ, and even the whole external nose, may be lost. Following gummy infiltration, the bone may undergo partial absorption without necrosis.

Various complications may arise from extension of the syphilitic infiltration to the sphenoid or ethmoid, such as meningitis, thrombosis of the cavernous sinus, or involvement of the optic nerves or those passing through the sphenomaxillary fissure, with symptoms similar to those complicating purulent inflammation of the accessory sinuses.

Diagnosis.—The diagnosis should rarely present much difficulty. The *primary sore* is rare and is hard. When ulcerated, the round superficial ulcer with smooth base differs from the ulcer of tubercle with irregular mouse-nibbled outline and ragged floor, with no surrounding induration. In doubtful cases the presence of the *Treponema pallidum* should be sought for.

Secondary syphilitic nasal coryza is usually accompanied by considerable general disturbance, and the nasal obstruction, with profuse discharge, at first watery, later purulent and fœtid, with lacrymation, photophobia, etc., should excite suspicion and lead to local inspection.

Tertiary syphilis may attack any part of the nose, but the loss of tissue is usually chiefly confined to the septum. The history and concomitant lesions will generally be enough to confirm the diagnosis which the nasal features suggest.

Syphilis in the nose must be differentiated from tubercle, lupus, malignant disease, and ozæna (see page 115). Tuberculous disease is most likely to be confused with syphilis of the nose, while the difficulties in diagnosis may be further increased by the association of syphilis with tubercle, lupus, or leprosy.

Treatment.—In addition to the general treatment appropriate to the particular phase of syphilis present, local treatment is usually necessary.

In young children at the breast, syphilitic catarrh, by interfering

with nasal respiration, may render suckling impossible. The child should be fed by the spoon till the condition has yielded to the internal administration of mercury in small doses. If, as is often the case, the infant declines all nourishment from any but the natural source, we may spray a weak solution (2 per cent) of cocaine, or a solution of menthol (20 per cent) in olive oil or liquid vaseline into the nares before putting the child to the breast, as recommended by McBride.

Local treatment in syphilis of the nose consists in the use of alkaline and cleansing douches to keep the passages free from the accumulations of secretion. In tertiary ulceration a spray or local application of peroxide of hydrogen followed by an alkaline douche and insufflations of aristol or iodoI tend to keep the fœtor under; calomel fumigations may be useful in checking the progress of the disease. With necrosis of the bone, it is generally useless to expect any means of overcoming

the stench to succeed, but frequent douching with solution of permanganate of potash is worth a trial. The dead bone should be gently encouraged to separate, and removed if possible. The removal of a sequestrum is sometimes a matter for consideration, for though a small or loose sequestrum should be removed at once, a large mass may be difficult to get away, and it is desirable, as far as possible, to wait till it has "separated" from the surrounding structures.

For the methods of treating deformities of the nose due to syphilis, see page 144.

In tertiary syphilitic lesions of the septum, necrosis of the septal bones is not very unusual. The intense fœtor caused by this

condition is difficult to overcome, but solution of permanganate of potash, used at least twice daily, is to some extent successful in removing the odour, while keeping the passages fairly cleaned.

It is well to remember that iodides sometimes aggravate nasal symptoms, and may even, in rare cases, give rise to conditions closely resembling syphilitic lesions. The case shown in *Fig. 38* was one of granuloma due to iodide of potassium, recorded by Crouch, who has kindly allowed me to reproduce his illustration.

The importance of prophylactic measures to prevent the possibility of others becoming infected is too obvious to require insistence here.



Fig. 38.—Nasal granuloma due to iodides administered to a syphilitic patient (CROUCH).

TUBERCULOSIS OF THE NOSE.

Etiology and Pathology.—Tuberculous disease confined to the nasal passages is somewhat rare. It more usually occurs in the course of pulmonary or laryngeal tuberculosis.

Weichselbaum, in 146 autopsies on patients who had died with tuberculous disease, found only two cases in which the nose was implicated, and though I have only seen a few of such cases myself, it is probable that a systematic examination of the nose in cases of advanced phthisis would show that it was less rare than is supposed. M. Herzog, who has reported 10 cases of his own, and has collected and reviewed the literature of all the instances recorded, 80 in number, finds it occurs in the form of (1) Neoplasms; or (2) Ulcers; or (3) A combination of both forms. In a collection of 90 cases by Heryng, ulcers were present in 48 cases, and in 42 tumours occurred.

1. **Tuberculous Deposits** are found from the size of a poppy seed to a large walnut, although they are seldom larger than a split-pea. They are soft and friable, and bleed easily, of irregular outline, rounded or elliptical, of reddish or greyish-yellow colour, surrounded by elevated soft margins, in which sometimes miliary tubercles are seen. This description applies to most of my cases, but I have seen a tuberculous growth on the septum which, in the early stages, was smooth and red, and well defined, resembling a small sarcoma or fibroma in appearance. The growth in the case from which the drawing (*Fig. 39*) was made subsequently ulcerated, resulting in a condition indistinguishable from the more usual form of lupous ulceration. Polyak also records a case of a tuberculous growth attached to the anterior portion of the septum, which on removal measured 30 mm. long, and 40 mm. thick. There was no tuberculosis detected elsewhere, either in this or in my own patient.

2. **Tuberculous Ulcers** here, as in the pharynx, are shallow, irregularly round or oval, with clean-cut, or with soft, slightly elevated margin, and presenting a greyish-yellow base filled with caseous tubercles. They are usually situated on the cartilaginous portion of the nasal septum, near the anterior border; but they may extend to the alæ nasi, or even to the upper lip. The tuberculous deposit, of course, consists of

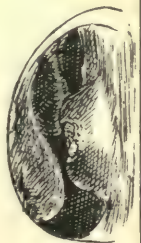


Fig. 39.
Tuberculous
neoplasm of the
septum.

granulation tissue, with giant cells, and contains tubercle bacilli, which are most abundant in the deeper layers.

Infection probably takes place from inoculation by the finger-nail. Purdon reports a case of a healthy patient who infected her nose by frequently lending her handkerchief to a consumptive sister.

Tuberculous disease of the nasal accessory sinuses is rare, but Gleitzmann in 1907 collected eighty-eight records of cases, including his own. With very few exceptions it was the antral cavity only that was affected; indeed there were only four recorded instances of frontal sinuses and one of ethmoidal and sphenoidal sinus tuberculosis. He cites Demme's case of a nurse with lupus of the septum and a dental fistula, who had apparently infected four children in the family she served, by her habit of tasting their food before feeding them; they all died of primary intestinal tuberculosis, though born of non-tuberculous parents.

Symptoms.—At first the symptoms are very indefinite, but as the deposit increases nasal obstruction may occur. The small miliary tubercles very soon ulcerate, and then pain comes on, and a mucopurulent discharge, often bloodstained, and becoming very foetid after continuing a short time. In fact, cases of tuberculous disease of the nose closely resemble ozæna, from which one may distinguish them by finding the characteristic bacillus in the discharge. The absence of pain is remarkable.

Diagnosis.—Tubercle may be differentiated from tertiary syphilis by the presence of tubercle in other parts, by the progressive character of the lesion in spite of anti-syphilitic treatment, and by the presence of the bacillus, and from its selecting the cartilaginous septum and not the osseous. It must also be distinguished from lupus, ozæna, fibroma, malignant disease, and chronic glanders.

Treatment.—When the nasal lesion is primary the diseased area should be removed; then the local treatment consists in thorough removal of the deposits by scraping, and the subsequent application of chromic acid, lactic acid, or the galvano-cautery, followed by some antiseptic insufflation daily, such as aristol, euophen, etc. Sometimes I have found fuming nitric acid the most useful application, followed by orthoform insufflations to obviate pain.

The disease is extremely prone to recur after a short period; it is therefore justifiable in suitable cases to consider the desirability of more radical operations. Lermoyez recently demonstrated a case affected with vegetating tuberculosis of the anterior parts of the nasal

passages, in which he obtained excellent results without deformity by detaching the alæ, resecting the entire septal cartilage, and curetting the floor and inferior turbinals.

But when the nasal affection is secondary to systemic tuberculosis, it is well to employ only simple alkaline and antiseptic nasal sprays or douches, and to rely largely on the usual general treatment for tuberculosis, which is as efficacious for nasal as for laryngeal tuberculosis.

LUPUS OF THE NOSE.

Etiology and Pathology.—Intranasal lupus is extremely rare, unless we include those cases of lupus of the alæ nasi which invade the vestibular portion. Without entering into the open question of the pathological identity of lupus and tuberculosis, it is certain that in many instances tuberculous disease in the nose passes into forms which are indistinguishable from lupus, and if the view that lupus is but a mitigated form of tubercle be correct, this resemblance can be readily understood. At any rate, the distinction, when possible, is clinically convenient.

The nodules occur generally as multiple, small, hard, elastic tubercles, covered with dry brown scales of inspissated secretion, or greenish-yellow pus. Beneath the scab will be found the characteristic ulcers, superficial, round or oval, with ill-defined margin, tending to cicatrize at one part and extend in another, and painful if pressed with a probe. They are generally situated on the septum, near the anterior inferior extremity, but the process may extend downwards over the floor of the nose, and thence creep up to the anterior part of the inferior turbinal. The middle turbinal is involved more frequently than the inferior. When the crusts separate there is a certain amount of bleeding, followed by seropurulent discharge, which may be offensive if the crusts have been long retained.

In some cases the nodules do not break down and ulcerate, but simply undergo degenerative changes with absorption, the atrophy leaving pale cicatricial areas.

The bones are very rarely, if ever, involved in the necrotic process, but the cartilaginous septum generally becomes perforated sooner or later.

Symptoms.—The patient usually complains of irritation in the nasal passage, but pain is generally absent or only slight; but even in the more advanced cases the symptoms are mainly those of nasal

obstruction, with a limited amount of intermittent discharge. Other symptoms will be present, of course, if the pharynx and larynx are involved. In one of my cases epiphora was the only symptom noticed, due to obstruction of the lower end of the nasal duct.

Diagnosis is generally easy, inasmuch as intranasal lupus is usually associated with lupus of the skin or pharynx.

Lupus is distinguished (1) from syphilis by the destructive process not extending to the bony structures, the tendency to heal, and the slight amount of discharge, and the absence of that intensely sickening odour of syphilis, which is not removed by the most careful cleansing ; (2) from malignant disease by its slow progress and tendency to heal, and from epithelioma, though not from sarcoma, by its occurrence in the young ; (3) from nasal tuberculosis by the appearance of the deposit, and its slow course. But, as already stated, it is often impossible to differentiate between lupus and tuberculosis of the nose.

Treatment consists in removal of the crusts, and thorough cleansing of the passages, followed by curettement and the application of lactic acid, or strong nitric acid and other local agents, as in lupus of the pharynx. Before applying either, and particularly when nitric acid is to be used, the parts should be carefully cleaned from blood and secretions, and great care exercised to prevent the acid running over the surrounding normal mucous membrane. A small patch may be destroyed by the galvano-cautery.

Tuberculin in minute doses may be tried with advantage. I have had successful results in several cases of lupus. The dose of the injection should never be sufficient to cause very marked local reaction, and for this reason it is well to commence with $\frac{1}{10000}$ gram of the new tuberculin of Koch, and gradually increase it.

The value of X rays, which is so fully recognized for lupus of the skin, is a doubtful quantity when the disease has invaded the cavity of the nose. Small accessible areas, however, may be cured by their use or by electrolysis. But there is not the same inducement to resort to these more tedious measures as in dealing with facial lupus, where cosmetic results are a serious consideration, and the more rapid and equally sure methods already mentioned offer a greater chance of preventing the disease spreading more deeply.

General treatment by tonics, cod-liver oil, iodide of iron, arsenic, etc., must of course be combined with local treatment.

GLANDERS.

Etiology and Pathology.—Glanders is a contagious disease of horses and cattle, due to the specific micro-organism, the *B. mallei*, but is occasionally met with in men, who generally contract it from infected horses, and thus it is usually seen in ostlers and grooms. For a full description of this systemic infective complaint, reference should be made to works on general medicine. It is rare for the initial lesion to occur in the upper respiratory tract; but as a result of systemic infection local manifestations in the nose are not so uncommon. Morell Mackenzie records a fatal case, which resulted from a diseased horse sneezing when being driven in a hansom, some of the secretion coming into the face of the patient who was inside.

It occurs in the acute and chronic forms. The disease may be chronic at the outset, subsequently passing into the acute variety.

Chronic Glanders closely resembles tertiary syphilis of the nose, but it is extremely rare. The mucous membrane of the nasal fossæ is slightly swollen and may be painful, and is covered with dirty scabs. There is a peculiarly viscid, offensive mucopurulent discharge, which when ulceration supervenes is serous. The ulcers may spread deeply, with consequent large perforation of the cartilaginous and bony septum, and the root of the nose, swollen and infiltrated, may become gangrenous. The disease may extend to the pharynx, back of the tongue, and larynx.

A large proportion of cases end fatally in six to eight months. As the bones are often implicated in the ulcerative process, the diagnosis from syphilis is rendered all the more difficult, and often depends on the absence of any improvement from anti-syphilitic treatment.

Acute Glanders is the commoner form of the disease in man, but, according to Böllinger, who collected 120 cases, it is less frequently localized in the nose than is the case in the horse.

Symptoms.—It usually begins with a pustular eruption on the face and painful nodules in the skin, which are soon associated with rapidly developing fever, at first intermittent, with general malaise, severe headache, furred tongue, foetid breath, and rheumatic pains in the joints. If the nose is affected, the patient experiences a dry burning sensation of the nasal mucous membrane, rapidly followed by a thin, watery, ichorous discharge, which soon gives place to a thick, viscid, glairy, and often sanious mucopurulent discharge, with external redness and swelling over the roof of the nose. Soon the ocular conjunctiva is

similarly affected, the eyelids becoming greatly swollen and œdematous. With these nasal manifestations the hyperæmic nasal mucous membrane becomes studded with a small nodular infiltration; the nodules increase in size and break down in the centre, leaving deep ulcers, which spread and coalesce, forming extensive serpigenous ulceration, with elevated margins and deep infiltrated base, covered with the glairy, mucopurulent, foul-smelling secretion. The disease may spread to the naso-pharynx, pharynx, and velum palati, or invade the larynx, which becomes œdematous, the lungs, and pleuræ. Diarrhœa, profuse sweating, vomiting, and general prostration, usually end in coma and death in less than three weeks.

Diagnosis.—The diagnosis rests on the general and local symptoms, and, in cases of doubt, the detection of the specific bacillus in the secretion or the application of the mallein test should be utilized.

The general symptoms closely resemble acute rheumatism or typhoid fever at the onset, but the extremely adynamic condition should serve to exclude acute rheumatism and tertiary syphilis, while the absence of other features serves to eliminate typhoid fever and small-pox, which is suggested by the small, hard, pustular nodules, with "rheumatic pains," severe headache, and fever. When infection occurs through the skin, the angry red inflammatory infiltration around the site of inoculation may resemble erysipelas or phlegmonous cellulitis. From anthrax it would be distinguished by the absence of the "charbon pustule."

Treatment is practically hopeless, but should be conducted on general principles, for which the reader will consult works on general medicine.

Locally, Elliotson reported success in stopping the nasal discharge by injecting a solution of 2 grs. of creasote in a pint of water three times a day. Other strong antiseptic agents will suggest themselves.

It is hardly necessary to emphasize the extreme importance of the most rigid prophylactic measures to prevent the inoculation of healthy individuals.

SCLEROMA.

(*Syn. RHINOSCLEROMA.*)

Etiology and Pathology.—The cause of this rare affection, originally described by Hebra, is uncertain, though Frisch and also Stepanow and Cornil have described bacilli which they claim as the specific infecting agent. The micro-organisms, which are found in

the Mikulicz bodies, are short, thick, blunt-ended bacilli, occurring singly, but most frequently in pairs or short chains. The bacilli are so short as to resemble diplococci, and have been likened to Friedländer's pneumococcus. The thickenings are mainly composed of two varieties of cells: (1) Large plasma cells, with homogenous protoplasm, and sometimes containing a nucleus near the border of the cell: these are the so-called Mikulicz bodies; and (2) Hyaline cells. Pieniazek and Lemeke hold that Störk's blennorrhœa, and the chronic subglottic thickening known as chondritis hypertrophica inferior, which follows Störk's blennorrhœa, are identical with rhinoscleroma.

A few cases of scleroma have been observed in this country and several in America, but these were all in patients who had come from the regions on the European continent where scleroma seems to find its natural habitat, viz., East Prussia and the South-east of Europe.

Formerly it was termed rhinoscleroma, as it was observed only in the nose and nasal passages, but scleroma attacks also the larynx or pharynx, and occasionally invades the trachea.

It generally commences in the vestibulum nasi in the form of small, hard, raised nodules, which very gradually spread to the nasal passages. The nodules are hard, tender on pressure, covered by normal skin, and non-inflammatory. It may begin in this manner in the nose, or may take the form, *ab initio*, of diffuse thickening of the mucosa, without showing any nodules. The mucous membrane is normal or slightly reddened in colour, smooth and shining, and very hard. The infiltration consists of small round cells which subsequently become spindle-shaped. There is no inflammation, no discharge or pain, and no ulceration. It may spread to the pharynx or the larynx, or even to the trachea, or the disease may commence in the pharynx or larynx without involvement of the nose. It generally occurs in advanced adult life, but Semon's case was in a boy of 14, a Guatemalan. Very few cases are recorded as having occurred in England, but it seems fairly prevalent in Austria and in some parts of Egypt, South America, and India. (See *Plate II.*, *Figs. 5 and 6*).

Symptoms are entirely local, viz., stuffiness of the nose or nasal obstruction, hoarseness, or, if the trachea is involved, dyspnoea and mucopurulent secretion. The course of this disease is very chronic, the onset being indefinite and insidious, and exhibiting very slow progress, sometimes increasing, then remaining stationary for a long period, then again progressing. The nose is peculiarly broadened, and the tip approaches the upper lip, so that the nose looks flattened.

The skin becomes indurated and knobbed, and the nose feels stiff. The nasal passages are narrowed by the smooth nodules, usually very hard, though sometimes soft, and by the contraction of the infiltrated mucous membrane. The nodules are at first pink, or greyish-pink, but as they get firmer and harder in course of time, they become rather greyish-white in colour. It generally spreads back gradually, and if the pharynx be involved, it creeps down the posterior surface of the soft palate to the palatal pillars and posterior wall. When the larynx is the seat of infection, it is the subglottic portion which generally suffers most, so that greyish-red nodular tumours may be seen projecting inwards, and it usually begins anteriorly, spreading backwards. The epiglottis may be attacked at its base.

The infiltrated tissues undergo contraction, somewhat like the cicatricial contraction of lupus or the adhesive form of syphilitic infiltration. Consequently the nose becomes stenosed, the soft palate peculiarly wrinkled, and ultimately the contraction of the palate and pharyngeal wall may cause a ring-like narrowing similar to the adhesion of the soft palate to the pharyngeal wall following syphilitic ulceration. The contraction of the subglottic infiltration causes the glottic aperture to assume a circular form, even if the cords themselves are not involved in the disease. The main symptoms, then, will be those due to obstruction to respiration.

Diagnosis is not always easy in the earlier stages, but the ivory-like hardness of the nodules and the absence of ulceration will form some guide, while the more advanced cases are almost unmistakeable. Unlike lupus or syphilis, there is no ulceration, although the separation of the crusts of secretion may leave an abraded, bleeding surface. The affection is most likely to be confused with either lupus or syphilis, and in doubtful cases the patient should always be put through a course of anti-syphilitic treatment. The diagnosis should, however, depend on cultures made by inoculating blood serum with a needle that has been plunged into the affected tissues, or from the blood issuing from the pricked spot.

Treatment.—The mechanical obstruction may be reduced by the galvano-cautery or knife. No treatment hitherto introduced appeared to be of the slightest use in arresting the disease till Stoukovenkow, of Kiew, had successful results in one case with interstitial injections of Fowler's solution of arsenic (1 to 12 per cent). The treatment was continued for fifteen months, and no less than 222 injections were made.

Both for external and mucous membrane infection the continuous application of X rays has appeared beneficial.

Freudenthal prepared rhinosclerine for the treatment of his case, acting on the results of Pawlowsky's researches, which showed that by these injections good results may be obtained.

Freudenthal* gives directions for the preparation of rhinosclerine, and includes an excellent description of the disease, to which, as well as to later contributions by Prof. Gerber, I am much indebted.

HENPUYE.

Henpuye, or "dog-nose," is an affection, causing a characteristic external deformity of the nose, which is practically confined to the natives of the Gold Coast of West Africa and the West Indies. Chalmers, from personal observation of numerous cases, states that henpuye starts as a small bony swelling symmetrically placed on either side of the nose, during or soon after an attack of yaws in which there is a history of the nasal mucous membrane being attacked. This swelling, generally oval with the long axis directed downwards and outwards, is attached to the nasal bones, the nasal processes of the superior maxillæ. It is produced by the deposition of cancellous bone under the periosteum. The growth is generally bilaterally symmetrical. The symptoms are pain in the nose, and later, headache, and pain in the swelling, during hot weather. Apparently the only effective method of treatment is removal by the saw and bone forceps.

* *New York Med. Journ.*, Feb. 1, 1896.

SECTION V.

DISEASES OF THE PHARYNGEAL TONSIL.

HYPERTROPHY OR POST-NASAL
ADENOIDS
CONGENITAL NASOPHARYNGEAL
STENOSIS

RHINOPHARYNGITIS
TORNWALDT'S DISEASE

THE collection of lymph follicles on the roof and posterior wall of the rhinopharynx, known as the pharyngeal or Luschka's tonsil, is similar in structure and liable to the same diseases as the faucial and lingual tonsils. It may be the seat of acute inflammation, keratosis, syphilis, tubercle, etc., all of which are described in connection with these affections of the tonsil and pharynx. But it very frequently becomes hypertrophic, and, in many cases, the adenoid hypertrophy is considerable, forming "post-nasal growths" which give rise to special and characteristic symptoms, the clinical importance of which, first emphasised by W. Meyer, in 1868, is now widely recognized by practitioners.

HYPERTROPHY OF THE PHARYNGEAL TONSIL.*POST-NASAL ADENOIDS.*

Etiology.—The Pharyngeal Tonsil is normally present at birth, and remains well developed up to the time of puberty, at which time it should begin to atrophy; so that at the age of about eighteen or twenty its dimensions are insignificant or it has wholly disappeared. The lymphoid tissue may be unduly developed at birth, and, as in the earlier years of life all lymphatic structures are especially active and respond to various incidental exciting causes of lymphoid hypertrophy, the symptoms generally date from birth or early infancy, and become well marked as the hypertrophy increases, by the fourth or fifth year, if not before. The majority of cases come under notice between the ages of five and fifteen, for although the hypertrophy

often persists in adult life, it usually participates in the retrogressive changes that normally occur at puberty, while the natural increase in the rhinopharyngeal space also diminishes the obstruction to respiration. All conditions which result in hypertrophy of the faucial tonsils, e.g., repeated catarrhal attacks and various exanthems, are likewise causes of post-nasal adenoid hypertrophy, and thus post-nasal growths and enlarged faucial tonsils usually co-exist. Not infrequently the symptoms date from an attack of measles, scarlet fever, or influenza. The influence of *heredity* is seen in many families, for it is by no means unusual for several brothers and sisters to suffer, and often enough the parents bear ample evidence in their faces of the mischief done by adenoid growths in their childhood, the results of which persist although the growths themselves may have long disappeared. Other evidences of inherited developmental defects are often found associated with the post-nasal affection.

It is often stated that nasal obstruction is a frequent cause of post-nasal growths, but though it may have some influence, I am convinced that it is quite a minor factor, and that its influence is sometimes unduly exaggerated. Indeed, we may go so far as to say that in a large proportion of children with well developed "adenoids," the mouth breathing is due not so much to mechanical obstruction in the nose, as to the rhinitis and consequent nasal catarrh maintained by the adenoids, for the catarrhal secretion occupies the normal air tract through the nose, and even when air can pass through the lower meatus, the child loses all inclination to nose-breathing and keeps the mouth open. (See p. 14.)

Pathology.—The growths are made up of lymph follicles, viz., a reticulum filled with lymphoid cells, the trabeculæ consisting of branching connective tissue cells, together with vessels and nerves. They are thus similar in structure to the enlarged faucial tonsils, excepting that there is much less connective tissue element, they are more vascular and soft, and the surface is covered with ciliated epithelium. Rarely they are tuberculous, and in a few instances they contain cysts.

"Adenoids" appear to be a lymphoid overgrowth directly resulting from the invasion of infective organisms. In some patients such invasion is productive of marked hypertrophy: these are described as of the "strumous diathesis"; in others the same measure of infection calls forth less marked hypertrophy. If the infective organisms continue to exist in the tissues and escape destruction, the patient suffers

from repeated attacks of catarrh, with a greater or less degree of systemic disturbance. Thus a tendency to catarrhal affections of the whole respiratory tract is almost constant in patients with adenoid growths, and this catarrh often results in intranasal obstruction.*

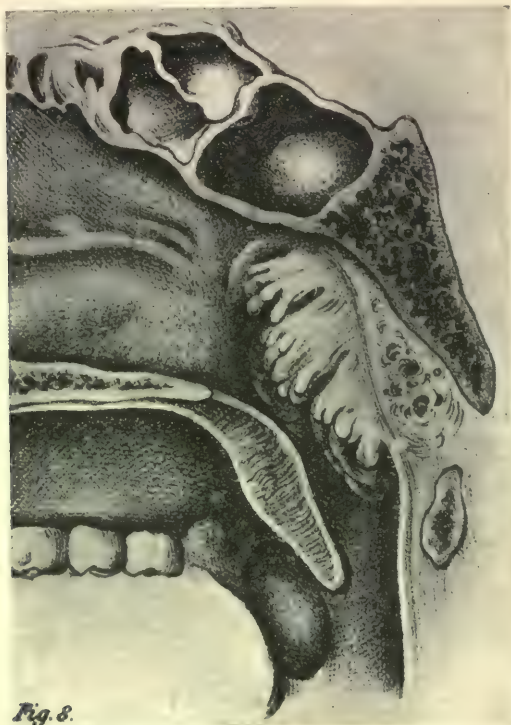


Fig. 8.

Fig. 40.—Adenoids.—Section through the post-nasal region in adolescence, showing hypertrophy of the pharyngeal tonsil (ZÜCKERKANDL).

Hence it is that **climatic conditions** undoubtedly influence the occurrence of the growths, which are more frequent in cold and damp climates such as Holland, than in warm and dry countries such as

* It is permissible to hope that if adenoids are the direct result of infection by organisms, vaccine therapy may in future obviate the necessity for operative treatment in certain cases.

Italy, where, according to Massei, the disease is but rarely observed in marked degree.

Bobone, of San Remo, even considers that pure and simple involution of adenoid growths is possible in the Riviera owing to the dryness of the climate, which also accounts for the extreme rarity of the vegetations among the natives there.

The growths occupy the roof and posterior wall of the rhinopharynx; in very young children they are more developed on the roof, but if developed towards puberty they are often confined to the posterior wall (see *Plate II.*, *Fig. 4*). Usually the hypertrophy either

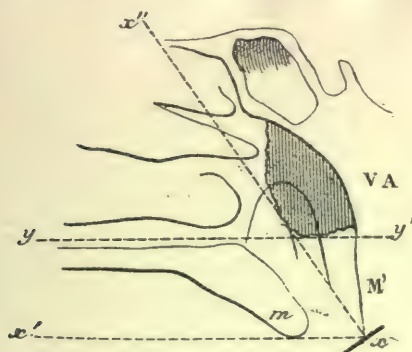


Fig. 41.—Diagrams of sagittal section of a rhinopharynx with post-nasal adenoids (after ZARNIKO).

(*VA*) Adenoids, the lower margins of which reach to level of yy , though on rhinoscopic examination, being viewed in the direction xx'' , they appear foreshortened.

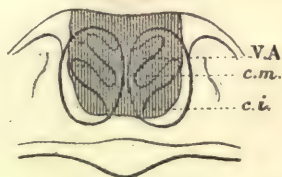


Fig. 42.—Actual vertical dimensions of the adenoids in *Fig. 41* (after ZARNIKO).

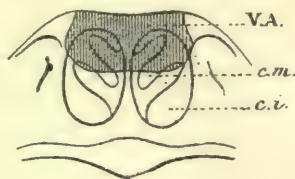


Fig. 43.—Dimensions of the adenoids in *Fig. 41* as they appear in rhinoscopy (after ZARNIKO).

forms a large central cushion-like mass, or is disposed in longitudinal ridges with intervening furrows which, being viewed by posterior rhinoscopy "end on," have the appearance of an irregular row of mammillary or pear-shaped projections. But in some cases the disposition of the lymphoid hypertrophy is much more diffuse, and may occupy the whole of the roof and upper part of the posterior and lateral pharyngeal walls, including the fossæ of Rosenmüller, and even the lips of the Eustachian tube and the salpingo-pharyngeal fold may be quite prominent and nodular in appearance from lymph-follicular hypertrophy. Bridges of lymphoid tissue may form, connecting the

Eustachian lips with the hypertrophied mass on the posterior wall. This diffuse form of hypertrophy may cause definite symptoms, although not blocking the posterior nares.

Symptoms.—There are no absolutely pathognomonic symptoms of adenoid growths, yet although the indications of their existence vary greatly in degree according to the position and amount of hypertrophy, they are generally sufficiently characteristic for the practised eye to make a diagnosis from the physical appearance and facial aspect alone. The nose, small and undeveloped, becomes pinched, the alæ nasi fall in from long-continued disuse, a dimple appearing between the superior and inferior lateral cartilages. The upper jaw is narrowed



Fig. 44.—The adenoid facies.

and the hard palate vaulted and V-shaped; and as the upper lip is short and retracted, it often fails to cover the prominent upper incisors. The naso-labial fold is more or less obliterated, the inner canthus of the eye is drawn down, causing drooping of the upper lid and a drowsy aspect. The open mouth and dropped jaw give an elongated, narrow appearance to the face (see Fig. 44).

Respiration is peculiarly noisy and snuffling, especially noticeable during eating and drinking, and during sleep. In the day-time, though the nasal passages are seldom completely blocked, respiration is chiefly conducted through the mouth. Buccal respiration and

breathing are particularly noisy at night, and suffocative night-terrors often occur, because during sleep the physiological nasal respiration re-asserts itself, and thus the breath is drawn less through the mouth and more through the obstructed nose, with snuffling and snoring and partial asphyxia until the child wakes.

The habit of breathing through the mouth and persistent respiratory obstruction leads to frequently-recurring colds and bronchial attacks, peculiar chest deformities, and imperfect aëration of the blood, conditions which result in defective growth and a general anæmic and weakly state of health. Symmetrical retraction of the cartilages of



Fig 45.—Deformity of chest due to adenoid growths in early boyhood.

the lower ribs and ensiform cartilage, causing a keel-like prominence of the sternum (pigeon-breast) and inframammary depressions, are very often due to persistent respiratory obstruction during childhood, when the chest-walls are soft and yielding, and in the majority of cases post-nasal growths are the source of the obstruction. The portion of the lungs corresponding to the retracted areas in the chest-wall are more or less collapsed. Moreover, as Eustace Smith has pointed out, the upper parts of the lungs are often found collapsed in very young children with adenoids. The patch of collapsed lung here produces dullness on percussion and weak, harsh breathing in the

supraspinous fossa ; sometimes very hollow breath sounds, conducted from the obstructed pharynx to the upper part of the chest on either side, leads to a mistaken diagnosis of grave pulmonary affections.

A peculiar, harsh, bronchial cough, bronchitis, and other pulmonary troubles are very commonly caused by post-nasal growths.

Speech is nasal and toneless, while stuttering and stammering are sometimes due to post-nasal growths.

Deafness.—The ears should always be examined. From extension of the pharyngeal catarrh the orifice of the Eustachian tube becomes blocked, and then from the gradual absorption of the air in the middle ear the tympanic membranes often become very much depressed, or from *otitis media purulenta*, perforation of the drumhead may result.

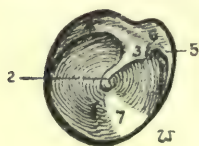


Fig. 46.—The normal right membrana tympani :—

(1) The membrane ; (2) The handle of the malleus, ending in the umbo ; (3) Short process ; (4) The posterior, and (5) The anterior fold ; (6) Membrana flaccida ; (7) The bright spot.



Fig. 47.—The appearance presented by a depressed (right) membrana tympani. The handle of the malleus is foreshortened, and the short process, as well as the posterior fold, is abnormally prominent. The bright spot is more diffuse and less distinct towards the periphery of the membrane.

Partly to the deafness, though largely to the deficient aëration of the blood and general impairment of health, are due the dullness, headaches, giddiness, and inability to fix the attention (Guye's *aproxexia*), that are such constant features in children with adenoids.

Many neuroses have been associated with adenoids, nor can it be a matter for wonder that lacking in stamina, stunted in growth, and defective in nutrition—as children with adenoids almost always are—they should exhibit marked instability of the cerebrospinal system. The co-existing nervous phenomena and adenoids are doubtless only indirectly interdependent in most cases, yet in a few it is permissible to regard the nervous disturbances as reflex neuroses ; thus such affections as asthma, stammering and stuttering, laryngeal spasm, nocturnal enuresis, convulsions, and even epilepsy, have been known to disappear shortly after the removal of the growths. The intimate association between the upper and lower respiratory tracts is well

shown by the frequently observed fact that inhibition of respiration may occur on introducing the finger or forceps into the rhinopharynx in operating, and probably the intensely disagreeable sensation of choking produced by digital exploration for adenoids is largely owing to the same cause. The constant irritation due to the presence of the growths, coupled with the pernicious effect of mouth-breathing on the bronchial mucosa, affords a ready explanation of the asthmatic phenomena.

Soft adenoids bleed very readily, and thus considerable quantities of blood may be coughed up, or pass into the stomach and be vomited.



Fig. 48.—To show method of holding the patient's head, and pressing the cheek in between the teeth with the left forefinger, in palpating for adenoids.

Examination may be made either by posterior rhinoscopy, or by palpation with the finger. It is of great assistance in subsequent operative treatment to obtain a good view of the extent and location of the growths, and, except in very young children, I rarely have much difficulty in seeing all that is necessary. Even when no post-nasal inspection is possible, one can often feel quite certain as to the existence of adenoids from the symptoms and the condition of the soft palate, which tends to hang flaccid and fails to retract quickly and normally on stimulation. Although if doubts exist one need not hesitate to palpate, I very rarely indeed find it necessary to resort to this unpleasant and, to nervous children, distressing procedure.

In every case one should view the nasal passages anteriorly, so that any intranasal cause of obstruction may be recognized and dealt with.

If the posterior nares can be inspected, we find either a group of pinkish-grey gelatinous-looking masses, or one large mass with irregular surface, growing from the roof and posterior wall of the naso-pharynx (see *Plate II, Fig. 4*). With small growths, only a part of the post-nasal space is blocked up, but the amount of growth varies greatly. The orifices of the Eustachian tubes and the upper part of the post-nasal apertures may be concealed by their presence.

When *palpation* is necessary for the purpose of diagnosis in children, the right fore-finger, protected by pressing in the cheek between the teeth by the left forefinger (see *Fig. 48*), must be quickly passed up behind the soft palate and swept over the whole post-nasal space so as to detect the presence, extent, and situation of any adenoids. The tip of the right finger should be passed **first behind the right posterior palatine arch and then up** to the roof of the pharynx, otherwise if the finger is inserted in the median line the palate is firmly retracted against the posterior pharyngeal wall, so that the finger cannot be made to pass up into the post-nasal space. In children adenoids are gelatinous, soft and pliable, and readily bleed, but they often have a firm fibrous base, while in adults the hypertrophy of the pharyngeal tonsil is deeper red in colour, firmer in texture, and less exuberant.

Attention should be directed to the condition of the faucial tonsils, and of the lymphatic glands in the neck, which are often enlarged.

Diagnosis.—In children the facial appearance already described is almost pathognomonic; nevertheless all the symptoms of adenoids may be due to nasal stenosis combined with defective mental development, and it is well to avoid too hasty a diagnosis until the post-nasal space has been either inspected or felt, and the diagnosis placed beyond dispute. But the result of digital exploration may be misleading in several ways: *Firstly*, the practitioner may not realize that in young children a pharyngeal tonsil is a normal structure and will readily bleed on palpation; the mere presence of some soft adenoid tissue which can be felt, or of blood on the exploring finger, does not warrant a diagnosis of post-nasal growths in the absence of characteristic symptoms. *Secondly*, in older children the finger may be directed only to the front part of the roof which may be free, while abundance of growth may lie undetected on the posterior wall of the space.

Thirdly, there may be no large mass, the hypertrophy being diffuse, or occupying the fossæ of Rosenmüller only, and thus may escape notice. *Fourthly*, enlargements of the posterior turbinal bodies may not only cause the symptoms of nasal obstruction but may be mistaken for adenoids by a careless or unskilful examiner.

The symptoms are not all due or proportionate to the amount of nasal obstruction, and the absence of mechanical obstruction to respiration cannot be held to exclude adenoid hypertrophy, which may be causing very pronounced symptoms calling for treatment, especially when the ears chiefly bear the brunt.

Prognosis.—The prospects of the patient depend less on the amount of hypertrophy than on the existence of complications, on the age at which the symptoms appear, and, above all, on operative treatment. The younger the patient the greater the risk of chest deformity, deafness, and permanent impairment of health; but, on the other hand, the most brilliant results of operation are obtained in young patients, because they have time to outgrow the effects of the disease before the period of physical and mental development has passed, never to return. In any case, provided operation be not delayed until the deafness, chest deformity, facial defects, and other complications have become permanently established, the prognosis is uniformly most gratifying. The anæmic, pasty, puny, listless, dull, woe-begone child becomes rosy, strong, bright, and intelligent, and instead of snuffling respiration, open mouth, and constant catarrhal and bronchitic attacks, the lungs are properly filled and respiration is normally conducted through the nose. Three questions are often put by the parents: "Won't the child grow out of the affection spontaneously?" "Is an operation necessary?" and "Will it afford a permanent cure?" Our reply should be as follows: If the child be under twelve years of age, while conceding that it is not unusual for the growths to atrophy spontaneously about puberty, and that the child may escape permanent injury, yet the patient ought not to be subjected to the constant ill-health and grave risk of serious complications when the defect can be overcome by an operation which, if skilfully done, is practically free from risk and almost certain to be entirely successful. We cannot definitely promise that the growths will not recur, for even after very thorough and complete extirpation they do return after a variable interval in a few cases, especially in young children.

If the patient is over the age of twelve, and no complications have

arisen, we may delay operation in the less marked cases in the hope that the growths will disappear at puberty.

Prophylaxis.—Adenoids once established cannot be removed by respiratory exercises, but in the incipient stage such exercises, with open-air régime and improved hygiene, may prevent adenoids developing.

Treatment.—Before referring to the treatment of post-nasal adenoids, it may be well to direct attention to the extreme importance of dealing with all the associated conditions, or those which stand in causal relation to the nasopharyngeal growth: firstly, the general health; secondly, the local conditions present, such as rhinitis and various causes of mechanical obstruction in the nose; and, thirdly, we often have to deal with mischief set up in the middle ear.

In cases requiring operation we should not delay removal in order that the general health may be improved first, for the operation will in itself largely remove the factors which have resulted in impaired vitality, and general tonic measures will then be much more effectual.

Anæsthetic.—For the removal of growths, in children at any rate, a general anæsthetic is desirable. The choice of the anæsthetic for these operations is at present an open question. In the removal of adenoids alone, the author prefers nitrous-oxide or ethyl chloride anæsthesia for children who can be persuaded to take it properly. If the tonsils also require removal, the anæsthesia is rather short; nevertheless, if a previous satisfactory rhinoscopic inspection has made it certain that there is only a central mass in the pharynx, a good administrator will obtain a sufficiently prolonged anæsthesia for the post-nasal growth and both tonsils to be removed. Every detail of the operative procedure must be arranged beforehand, as it must necessarily be very rapidly and skilfully executed.

If for any reason, and this often is the case, a longer anæsthesia is required, ethyl chloride followed by ether and chloroform is generally preferable, given till anæsthesia is just complete, care being taken to avoid pushing it to the abolition of the laryngeal reflexes. Others again regularly prefer ether for adenoid operations, as there are no special untoward effects from it either during or after operation.

Method of Operating.—The patient should be in the *recumbent position*, the head hanging over the end of the table, so that blood may

escape by the nose and not enter the larynx ; or in the *lateral position*, with the face looking slightly down. The patient may be in the sitting posture if ether or ethyl chloride be used, but I always have the patient in the recumbent position, except when nitrous oxide only is given. In older patients the use of cocaine does away with the necessity for a general anæsthetic.

Some operators usually remove the growths with cutting forceps, but it is generally better to use a curette. Gottstein's curettes, as modified by StClair Thomson or by Beckmann, are the most useful for removing the large masses in the vault and posterior wall, and have the advantage of being very safe instruments. The curette,

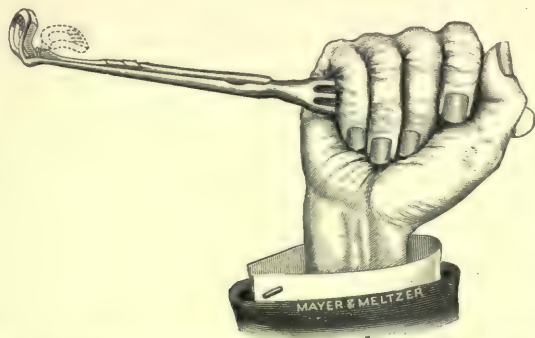


Fig. 49.—StClair Thomson's adenoid curette, showing the "proper" method of holding it. The author always holds adenoid curettes as one holds a table fork.

passed well up behind the soft palate, is gently but firmly pressed against the vault, and as it is drawn down over the posterior wall is made to include and cut through the hypertrophied pharyngeal tonsil. Schultz's adenotome is only used by a few foreign operators.

After using the curette, the finger may be introduced to ascertain whether any portions of growth still remain for removal, and that the operation is complete and satisfactory. For tough growths it is sometimes, though very rarely, necessary to use forceps, and of the many forms of this instrument StClair Thomson's or Dundas Grant's are the ones I prefer.

When both tonsils and adenoid growths have to be removed, first operate on the pharyngeal growths and then the tonsils, unless the latter are so very large that they interfere with the passage of

instruments into the rhinopharynx, in which case the order of removal should be reversed. One reason for the order suggested is that hæmorrhage in the nasopharynx can be readily controlled and the blood kept out of the mouth by pressing a sponge tampon into the nasopharyngeal space, so that when the tonsils come to be removed the parts are not encumbered with blood, but once the tonsils are cut the bleeding must be very profuse for some minutes, and cannot be controlled at once.

Dangers of the Operation.—Apart from the dangers due to lack of skill or to operating on a struggling child—e.g., injury to the soft palate, the posterior border of the septum, and to the Eustachian tubes—there is always the possibility that with the free hæmorrhage a clot of blood may be drawn into the larynx and cause asphyxia. Fortunately I have never had any misadventure in any case, either during or after the operation, but accidents have occurred to the most skilful, and one ought always to have everything ready at hand to do tracheotomy should it become necessary. The chance of blood getting into the larynx is very slight if the head is kept well down and the anæsthesia is never pushed deep enough to abolish the laryngeal cough reflex.

Violent hæmorrhage may occur from an abnormally-situated internal carotid artery or ascending pharyngeal artery at the time of operation. Secondary hæmorrhage may come on after the operation, and if it trickles down the pharynx and is swallowed, large quantities of blood may be lost without any suspicion of what is occurring. Death has resulted in two instances from profuse secondary hæmorrhage in “bleeders.” It may be necessary to plug the post-nasal cavity, and in the more severe and uncontrollable hæmorrhages ligature of the common carotid may be necessary. More than one case of sudden death at the commencement of operation has occurred, the pulse and respiration stopping synchronously without warning (attributed to chloroform neuro-paralysis). In another instance a fatal result was due to convulsions coming on a few hours after the operation was completed; in another, fatal secondary hæmorrhage occurred on the eighth day after operation.

It is well not to minimize the dangers of the operation too much, for though with skill and care the risks are infinitesimal when compared with the enormous benefits accruing from the operation in patients for whom it is really required, many fatal accidents have been recorded. In 1896 Holloway tabulated eleven deaths under chloroform in

operations on the tonsils and post-nasal adenoids reported in England between May, 1892, and April, 1895, and since then Hinkel has collected nine others, making twenty in all—six for adenoids alone, three for adenoids and enlarged faucial tonsils, and two for enlarged faucial tonsils alone. In four, death occurred before the operation was begun ; in three, from a few minutes to an hour after the operation was completed. But many additional deaths have occurred since these cases were collected. Doubtless many of the deaths were due to the chloroform, and Hinkel adduces evidence which tends to show that there are some special risks with chloroform anæsthesia in the subjects of lymphoid hypertrophies. For these reasons some anæsthetic more free from risk is desirable when it answers the purpose.

The **Status Lymphaticus**, a rare affection, the existence of which is always difficult and usually impossible of recognition during life, has accounted for several sudden deaths from anæsthesia prior to, or in the course of, operations for adenoids. Marked splenic enlargement should lead to the suspicion of this affection, and is therefore an indication for special caution.

After-treatment chiefly consists in guarding the patient against the risk of catching cold, and thus setting up otitis media, etc., my usual rule being for the patient to remain in bed for one day, in the same room for two days more, and not go out of the house for a further two days. For the first few hours, sucking ice and sipping iced milk lessens any pain or discomfort, and decreases the inflammatory reaction. The food should be light, cold, and soft—such as milk, junket, beaten eggs, custard, and jelly—for a day or two until soreness on swallowing has disappeared.

It is generally undesirable to use any spray or local application for fear of setting up otitis media, and the patient should not be allowed to blow his nose vigorously until several days have elapsed—firstly, because the effort may cause hæmorrhage within a few hours after operation ; and, secondly, because there is a risk of driving purulent débris into the Eustachian tubes. For similar reasons, in cases where deafness with retracted drums requires further treatment, no inflation of the tubes should be commenced until the pharyngeal wound has healed, unless, of course, purulent middle-ear disease and perforated drums already exist.

Failure to obtain successful results from the operation may be due to several causes, viz. :—

Firstly, The growths may not be completely removed, enough being left behind to maintain the catarrhal condition and cause rapid recurrence. Incomplete extirpation may be due to an abnormal projection of the anterior tubercle of the atlas, rendering access to the pharyngeal vault and posterior wall above it very difficult unless forceps with a backward projection of the cutting blades are used, such as Quinlan's. Similarly, an excessively developed pharyngeal tubercle or an exaggerated rostrum of the sphenoid may project from the vault and interfere with the movements of the instrument. Sometimes these rare bony (or cartilaginous) projections come away in the course of operation. Comparatively small lymphoid masses in the fossæ of Rosenmüller or bridges between the Eustachian tubes and the pharyngeal wall may readily be left behind by a careless operator; then, though all obstruction to respiration may be removed, the ear complications may persist.

Secondly, Intranasal stenosis may co-exist, untouched by removal of post-nasal obstruction. Some chronic rhinitis is generally present in the subjects of adenoids, but usually subsides spontaneously after the cause, viz., the adenoids, is removed. A more common cause of failure is the falling in of the alæ nasi from long disuse of the dilator muscles. The anterior nares are small and ill-developed, and during inspiration the alæ are drawn in and act like a valve. The patient should be trained, if possible, to dilate the nares on inspiration, by taking a series of deep, full inspirations, with the mouth closed, at least once a day; in the case of young children such exercises must be properly supervised.

Artificial dilators are useless, for they cannot be worn always. The intranasal stenosis may be due to co-existing masses of adenoid tissue on the posterior part of the septum nasi; to hypertrophy of the inferior turbinals; or to nasal polypi, deviated septum, etc., conditions requiring appropriate treatment, described elsewhere.

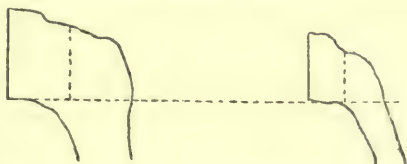
Thirdly, Buccal respiration may persist simply from habit, the patient may be mentally defective, or deafness and other complications may be pronounced and incurable. In others, the narrowing of the V-shaped palate renders the relation of the upper to the lower jaw abnormal; or the protruding teeth with short lip and weak orbicularis oris may make it difficult for the child to keep the mouth closed, and thus a vacant expression may persist for a long period.

Lastly, Recurrence takes place in some few cases, despite complete extirpation and the absence of any removable sources of failure.

CONGENITAL NASAL AND NASOPHARYNGEAL STENOSIS.

Etiology and Pathology.—Congenital stenosis of the nasal passages may be referred to here in connection with post-nasal adenoids, because the facial aspect and other symptoms of these two distinct affections have in many respects a close resemblance, and it is necessary to differentiate them.

By artificially occluding one nostril in young puppies, Zeim has shown that the absence of nasal respiration may result in defective development of the bones of the corresponding side of the face, but the nasal passages in the human species are sometimes found to be occluded on one side by congenital web formations anteriorly, or by bony stenosis of the choanæ, without any external defect. Yet if the stenosis is bilateral the facial aspect acquires the defects commonly associated with the post-nasal adenoids. Escat has further drawn attention to cases in which the so-called adenoid facies was associated



Figs. 50-51.—*Fig. 50* is an antero-posterior section of the healthy rhinopharyngeal space of a child of ten; it is the mean of seven casts. *Fig. 51* represents the same space of an older child, one aged eleven and a half years, but affected with congenital stenosis (Escat).

with congenital stenosis of the rhinopharynx, without adenoids being present. The patients are generally weak-minded, and hence a careless observer might erroneously attribute the mental defects to the aprosexia of adenoids, whereas careful examination would exclude their existence and reveal the true nature of the defect.

NASOPHARYNGEAL CATARRH.

POST-NASAL CATARRH.

It is obvious that a discharge from the nasopharynx may either originate in the nasopharynx itself, or may originate within the nasal passages or accessory sinuses and pass thence to the post-nasal space. In the first case the affection is a disease of the nasopharynx, but in

the second class the symptoms may be the same but the disease is purely nasal.

In the light of fuller knowledge of accessory sinus disease, it is evident that many cases formerly regarded as chronic post-nasal catarrh are really instances of latent accessory sinus disease, and often it is the sphenoidal sinuses which are the source of the secretion in the rhinopharynx. Even when the patient has complained of no symptom of intranasal or accessory sinus disease, investigation should be made to exclude such possible sources of the discharge before concluding that the case is a true "post-nasal catarrh" and nothing more.

Etiology and Pathology.—**Acute Nasopharyngeal Catarrh** usually accompanies attacks of acute rhinitis and pharyngitis from whatever cause arising, but generally disappears with the subsidence of the acute cause, e.g., cold in the head, measles, scarlet fever, etc.

Chronic Rhinopharyngeal Catarrh may follow on repeated acute or sub-acute attacks, or may be due to any of the numerous causes of chronic pharyngitis, e.g., gout, dyspepsia, etc. To these must be added neglected adenoids of childhood. The essential pathological

factor in true post-nasal catarrh of adults is often disease of the pharyngeal tonsil, and in a considerable proportion of cases it will be found, on rhinoscopic examination, that the pharyngeal tonsil has not undergone the normal involution that commences at the time of puberty, and that adenoid growths dating from childhood, though partially atrophied, still exist. In many such cases the remains of the pouch of Rathke, the *recessus medius*, is obvious, and this appearance led Tornwaldt to describe the condition as a separate disease.

But it is important to recognize that the so-called catarrh may be due to syphilitic, lupous, or tuberculous disease in the rhinopharynx.

Post-nasal catarrh has erroneously been attributed to nasal stenosis and what is termed "negative pressure," resulting from nasal obstruction, but such causes are more or less hypothetical.



Fig. 52.—Cleft palate exposing the remains of Luschka's tonsil and showing a well-marked *recessus medius*, the source of so-called Tornwaldt's disease (CARWARDINE).

The Symptoms are similar to those of chronic pharyngitis, together with excessive secretion from the post-nasal space. Tinnitus aurium, deafness, and other evidences of implication of the Eustachian tubes in the catarrhal process are commonly present.

Treatment consists in overcoming any underlying systemic causes, e.g., dyspepsia, constipation, portal congestion, etc. Sea-bathing, a change of air, the administration of tonics, and regulation of the diet are generally called for. Locally, a post-nasal spray or douche, with some mild alkaline solution, e.g., Dobell's solution diluted with four parts of warm water, or one compound eucalyptia soloid (B.W.) to the pint of water may be used with advantage once or twice daily. If considerable hypertrophy of the pharyngeal tonsil is present, it should be removed; but it is very important not to attribute the symptoms to any slight departure from the ideal conformation that may be discovered.

The treatment, in fact, which is most beneficial is the same as in chronic pharyngitis.

SECTION VI.

NEOPLASMS OF THE NOSE AND RHINOPHARYNX.

MUCOUS POLYPUS
BENIGN NEOPLASMS

MALIGNANT NEOPLASMS

MUCOUS POLYPUS.

THE only common form of benign neoplasm of the nasal passages is the mucous polypus. Zückerkandl found polypi in as many as one out of every eight or nine autopsies in which the nasal passages were carefully examined, from which it must be inferred that they exist in a great many people without producing definite symptoms.

As the successful treatment of nasal polypi and of the conditions leading to their development must depend largely on a correct interpretation of their etiology and pathology, it is necessary to enter rather fully into these much debated questions.

Etiology and Pathology.—The pathogenesis of these polypi is very obscure. They are more frequent in men than women, and though rare before puberty, they are met with even as early as the seventh or eighth year. They may result from chronic catarrhal conditions, although Morell Mackenzie refuted this suggestion, pointing out that polypus is rare before the age of sixteen, while chronic nasal catarrh is especially common in young children. Now a mucous polypus grows slowly, and it seems probable that the earlier stages in its development, i.e., before it can be seen in the nasal passages as a formed polypus, may extend over a period of months or years, and this affords an explanation of the rarity of polypus formation in childhood. But these early stages of the disease in the implicated area in the nasal mucosa may be attended with symptoms due to resulting irritation, viz., sneezing, rhinorrhœa, and even asthma; hence rhinorrhœa and asthma, which are obvious long before the polypus can be detected, are too often assumed to be the cause of the polypi—whereas they are in reality the consequences.

Nasal polypi may be primary, or they may be secondary to disease of the accessory cavities. Doubtless there is a causal connection between suppuration in the nasal accessory sinuses and mucous polypi. The ethmoid bone is usually diseased at the seat of the polypi.

The (so-called myxoma) mucous polypus is composed of fine meshes of areolar tissue filled with fluid containing serum-albumin and mucin, and covered with the ciliated epithelium of the mucous membrane when small, though this normal ciliated epithelium is gradually lost and replaced by stratified epithelium as the polypus becomes larger. It contains a variable amount of glandular tissue, generally only a few mucous glands being present, and only very rarely is the glandular element so preponderant as to constitute a fibro-adenoma.

From cystic degeneration of the mucous glands we get one form of cystic polyp, but in other polypi, in which the glandular element is almost or completely absent, simple liquefaction of the contents may give rise to one large cyst. Thus we might differentiate the varieties of mucous polypi by the terms :—

Fibroma œdematosum
Cysto-fibroma-œdematosum

| Fibro-adenoma-œdematosum
| Cysto-fibro-adenoma-œdematosum

The exposed portion of a polypus from frequent irritation will sometimes develop a papillomatous structure; thus papilliform œdematous polypi are met with in association with ordinary œdematous polypi. Jon. Wright, in a series of specimens, has observed histologically all stages of an apparent transition from the ordinary smooth form to the papillary form, in which the surface and the glandular epithelium alike proliferate.

Mucous polypi fall into two distinct pathological groups :—

(a). The origin of the polypus is most frequently associated with, if not actually due to, inflammation of the mucous membrane, resulting in hyperplasia of its tissues, including the periosteum (therefore definitely infective in origin). The infiltrated area becomes œdematous and vascular, and a fibrous stroma is formed from the connective tissue cells.

(b). But another group, and by no means inconsiderable proportion of nasal polypi, are not associated with obvious inflammatory changes, but with recurrent vasomotor phenomena of nervous origin. To this group belong those cases where one polypus only exists and persists for a long period, growing steadily till it is removed and the

trouble is then at an end. Again, localized œdematous infiltration not rarely precedes, follows, or arises in the course of attacks of asthma, and with frequently repeated asthmatic paroxysms the polypoid mucosa tends to persist, and once the polypus is originated it tends to increase in size. Probably the pathological processes that cause the development of the polypus also determine the occurrence of asthma in these cases; but just as asthma is sometimes determined by gastric disturbances, although the majority of patients who suffer from dyspepsia do not get asthma, so also these nasal affections may cause asthma, although the vast majority of patients with intranasal disease do not get asthma, and a large proportion of asthmatics have no nasal disease at all.

Theories as to the Origin of Polypi.—Having briefly reviewed the pathological conditions and predisposing factors, we may seek to explain how a polypus comes to be formed.

1. *The Author's Lymph-Vascular Theory*: that usually a "mucous" polypus is the result of localized invasion of the tissues by pathogenetic organisms not necessarily pyogenetic, and probably often of lessened virulence. Organisms invade the epithelium, enter the lymphatic spaces, and are carried to the small lymphatic vessels, which, with or without consequent endolymphangitis, become entirely occluded. The blood vascular supply remains unaltered, and the very active secreting functions of the affected mucosa persist, while the fluid poured into the lymphatic spaces fails to be removed, and accumulates in that implicated area. If this occurs close to the surface a corresponding elevation of the epithelium is seen to protrude (see *Plate X*); if deeper in the mucosa, a pale area of œdematous connective tissue arises (see *Plate X*). In either case, as the accumulation increases, the area corresponding to the blocked lymphatic steadily increases, till a minute elevation begins to protrude, and becomes a small mucous polypus. If the supply of infecting material ceases, the arrested lymphatic circulation may re-establish itself and the polyp may disappear; but if the lymphatic vessel is permanently blocked, the polyp continues to grow till it may attain enormous proportions. Inasmuch as the area involved for any particular polyp, as far as the surface of the mucous membrane is concerned, is the restricted territory of the involved lymphatics, the polyp, however large, has a relatively narrow pedicle of origin. (*Plate XXXIV.*) But in many cases the periosteum is implicated, and the inflammatory changes there set up result in the bone changes so frequently observed in association with

PLATE X.

SECTIONS SHOWING THE GENESIS OF A NASAL
MUCOUS POLYPUS.



Fig. A.—Section showing (in centre) area of marked cell infiltration surrounded by oedematous area (1 inch obj.).

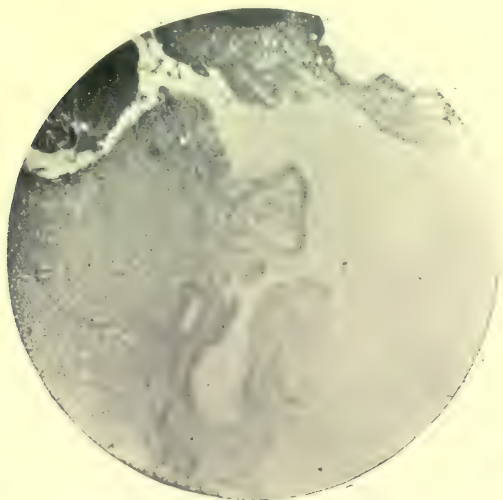


Fig. B.—Photo-micrograph of section showing a projecting localized oedematous infiltration with a distinct pedicle, i.e., a commencing polyp (1 inch obj.).

polypus of the nose. Accessory sinus disease is a constant source of infective organisms, and thus is very often associated with mucous polypus. But the mucous membrane of the diseased accessory sinuses, like that of the middle turbinal region, naturally displays the same liability to develop mucous polypi. Gravity has very little to do with

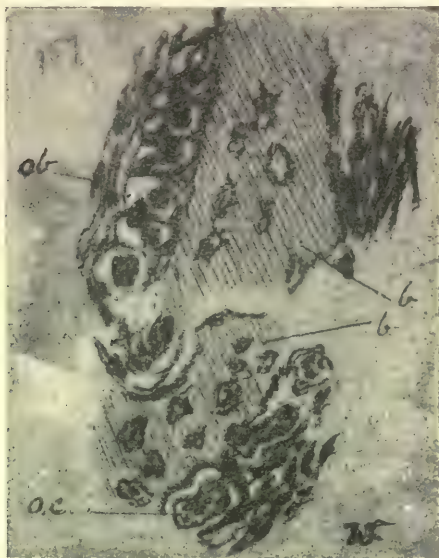


Fig. 53.—Section from the base of a mucous polypus, showing a bony spicule, *b* ; with osteoblasts, *ob* ; and osteoclasts, *oc*.

the development of a polypus, although when once formed it may determine the direction in which it will lie.

Of various other theories of the pathogenesis of nasal polypi the following may be mentioned :—

2. *Hoffmann's** *Theory* that the localized œdema is due to some impairment of the efferent venous radicles, with consequent exudation. Such theories overlook the fact that normally the veins are temporarily obstructed, with consequent distention of the venous sinuses of the erectile tissue, and that there is no macroscopic or histological evidence of venous engorgement in nasal polypi.

* *Wien. med. Presse*, 1883.

3. *Osteitis Theory*.—Woakes believed that polypus is only a symptom of bone disease, which he terms “necrosing ethmoiditis.” But there is seldom any clinical or pathological evidence of *necrosed* bone; what we often find is an osteitis, rarefying and formative, as shown in the drawing (*Fig. 53*) of a section from the base of a mucous polypus. Zückerkandl, in reference to this question, states that he has not observed necrosis of the bone in a single case, but that he has seen the bony part which exists in the base of some polypi become elongated and softened. The layers of the periosteum often undergo inflammatory changes which result in this *osteitis* and in hyperplasia of the fibrous connective tissue, by œdematous infiltration of which the ordinary polypus is formed. Thus we may often detect rough or bare bone, or a sense of softened carious bone conveyed by the contact of a probe with the bony trabeculæ at the base of the polypi.

Woakes’ theory that polypi are secondary to pathological conditions arising in the underlying bone has been elaborated on more recent and sounder histological investigations by Lambert Lack, who states that “polypi, in fact, may be regarded as circumscribed œdematous infiltrations of the nasal mucous membrane, *the result of osteitis in the underlying bone*.” No adequate explanation is afforded of how or why osteitis of the underlying bone arises as the primary and essential pathogenetic factor, and while my own investigations lead to the conclusion that the mucoperiosteum, and consequently the bone, rarely escapes involvement in the infective processes above described, it appears to me almost as reasonable to argue that because a tuberculous lung rarely escapes without some tissue destruction, therefore destruction of areas of lung tissue is the cause of consumption, a line of argument that is described as “putting the cart before the horse.” I entirely concur in the statement of Goodale* that “neither rarefying osteitis nor hyperplastic bony alteration is essential to the formation of polypi. The polyp is an œdematous hypertrophy of the mucous membrane in which, just as in the case of firm hypertrophy, the process may be limited to the superficial layers or extend to the depths.”

4. That diffuse œdema of the mucous membrane arises from repeated or severe attacks of acute catarrh (coryza), and, the catarrh becoming chronic, the tissues of the nose are constantly soaking in their own secretions, and a return to normal is thus prevented. The loose

* Posey and Wright, “*Diseases of Eye, Ear, and Nose*,” ii., 708.

œdematous mucosa sags down, and then becomes acted on by the respiratory air currents. This is the theory of Fraser, who, curiously enough, considers that it is "*therefore* not difficult to understand that in some cases the base becomes constricted so that a pear-shaped swelling results."

5. That polypi are essentially granulations modified by the special conditions under which they grow in the nose. Greville Macdonald, who enunciates this view, considers that polypi may result from any irritation of the nasal mucosa productive of granulations. But granulations often occur in the nose without any polypus developing, and moreover, granulations and polypi are histologically different.

6. Yonge's theory is that degeneration and cystic dilatation of the mucous glands are the determining causes, the œdema being secondary to gland degeneration.

Though from cases coming under treatment we find that mucous polypi nearly always arise from the middle turbinal, or from the margin of the hiatus semilunaris, Zückerkandl found from post-mortem examinations that they are very frequently situated in the superior meatus, or on the superior turbinal. They may arise in any accessory sinus. Examples of polypi in the frontal and sphenoidal sinuses are shown in *Plates XXXV and XXXVI*.

Symptoms.—The most prominent symptom is stuffiness or obstruction in the nose, varying, of course, with the size of the polypi. The patient can often feel something which "flops" to and fro on inspiration and expiration, and may be distinctly conscious of some loose body in the nasal passages.

The nasal secretions are in excess, and the constant sniffing and running at the nose are extremely annoying. If nasal respiration is much obstructed, mouth-breathing, with its attendant evils is present, the voice becomes nasal, muffled, and without resonance, and the sense of smell is lost. As the growth increases in size it may press upon and obstruct the orifices of the accessory sinuses (with consequent retention of the secretions of the antrum, frontal sinus, etc.) or of the nasal duct, giving rise to lachrymation and epiphora. Mucous polypi, if large, often cause deviation of the septum, but while the nose may appear broadened from some œdematous infiltration, external bony displacement is hardly ever seen.

Patients generally find the symptoms aggravated in damp weather, not owing to the hygroscopic properties of the polypi, but from the effect of damp on the rhinitis which almost invariably co-exists.

Catarrhal deafness may supervene from associated nasopharyngeal catarrh, or from direct pressure on the Eustachian tubes.

True nasal neuroses are not commonly set up; but, as in Voltolini's classical case, asthma is sometimes due to the presence of a polypus. (See NASAL NEUROSES.)

Objective Examination seldom leaves any room for doubt as to the diagnosis. If the polypus has attained any size, and is situated anteriorly, it will be seen as a characteristic semi-translucent, greyish-pink, gelatinous body, occupying the middle meatus, or reaching down to the inferior meatus, or even presenting at the anterior nasal orifice. Unless very large it is generally possible to determine its seat of origin, which, as stated above, is generally beneath or from the free border of the middle turbinal. Less frequently its attachment, as already demonstrated, is higher up, e.g., the fronto-nasal duct, the superior meatus, or posteriorly, the sphenoidal sinus. A true mucous polyp never originates from the inferior turbinal, and hardly ever from the septum.

When the polypus is large only one may be seen, but they are generally multiple, and, more often than not, bilateral. Mucous polypi are sometimes very large. Thus Zaufal reports the removal of one more than 6 inches in length, and weighing over $3\frac{1}{2}$ ounces; and Delie had a patient from whom he removed a mass of polypi weighing 103 grams—63 grams from the right nostril, and 40 from the left. In many cases no large polypus is present, but there are numerous small polypi the size of currants, or smaller, beneath or attached to the free edge of the turbinal. Sometimes the free border of the middle turbinal has undergone polypoid degeneration when no definite pedunculated polypus is present.

When a polypus is deeply seated, it may often be made to come to the front by the patient blowing the nose vigorously. But when thus growing far back, or when the polypus has extended backwards towards the posterior nares, the diagnosis can only be made by a posterior rhinoscopic examination, which shows the polypus protruding from the choanæ into the rhinopharynx, or even completely filling it, so that it hangs down and appears below the soft palate.

Large polypi, which have undergone compression by surrounding structures, tend to lose their usual œdematous appearance, and become more solid and fibrous on the surface, and, if coming well into the anterior nares, may be red and lobulated, and simulate papillomata in appearance.

Examination of these polypi with a probe will always show them to be soft and freely movable, and that they are not connected with the septum or inferior turbinal, while they are readily penetrated by a sharp needle.

Polypoid Cysts, due to obliteration of the duct of a gland, with gradual distention of the cyst by retention of secretion, are occasionally found growing from the inferior turbinal at or near its posterior end. When large they very closely resemble the true mucous polypus, and often their real nature is not diagnosed until in the process of removal the thin wall ruptures, and with the escape of the watery contents the polypus collapses (see p. 108).

Diagnosis.—Mucous polypi must be differentiated from fibrous polypi, cancer, and sarcoma, all of which are painful, bleed freely when probed, are firm in texture, and, if large, produce bony displacement. Primary carcinoma of the nasal fossæ is exceedingly rare, but it should be noted that nasal polypi may occur with malignant growths of the nose. Chronic abscess of the septum, and bloody tumour which results from blows, are generally bilateral, and are situated on the septum. Papilloma, hypertrophy of the lower turbinated body, and foreign bodies, will hardly give rise to confusion on careful examination, while cartilaginous and osseous tumours are hard and present other distinguishing characteristics.

There should be no difficulty in distinguishing a polypus in the nose. from (1) Hypertrophy of the inferior turbinal; (2) Symmetrical adenoid growth on the septum; (3) Post-nasal adenoids; but it is not easy to make a diagnosis by inspection alone from those rare cases of fibrous polypi growing from the nasal cavities towards the rhinopharynx.

It is most important that the co-existence of accessory sinus disease should not be overlooked, and careful investigation should be made in reference to this question in every case of polypus.

Treatment consists in (1) Removal of the polypi, and (2) Treatment of the abnormal conditions which have caused their growth.

Of course, before polypi are removed, cocaine (10 or 20 per cent), eucaine, or novocaine should be used. This should be applied, as far as possible, to the root of the polypus and to the mucous membrane of the nasal fossa, and not simply sprayed on to the polypus itself, which is practically devoid of sensation. For this purpose a spray with a fine nozzle that can be introduced between the polypus and the inner and outer wall of the nares should be used. In young children it is sometimes necessary to use a general anæsthetic, the

posterior nares should then be plugged to prevent the escape of blood into the rhinopharynx, with the necessity of constant mopping.

The only methods of removal which merit discussion are (a) avulsion, and (b) snaring.

Avulsion, by seizing the polypi with suitable forceps, has been extensively condemned by many specialists, who advocate the use of the snare as the only justifiable means. To blindly introduce forceps and tear away whatever happens to have come within their grasp is indeed a disastrous procedure, but when the position of the polypus has been made out, and forceps are used with skill and care, they are a very efficient means of getting rid of the growths.



Fig. 55.—The author's forceps shown in situ removing polypi at their narrow base.

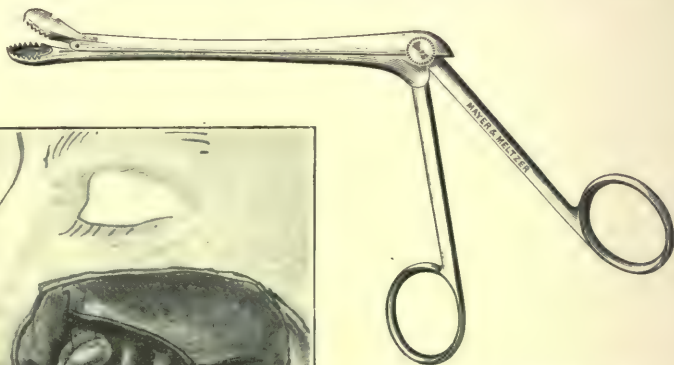


Fig. 54.—The author's polypus forceps.

There are two conditions in which forceps must be employed, viz., when it is impossible to introduce the loop of a snare owing to the size or situation of the

polypus, or when a number of small sessile polypi occupy the middle meatus and cannot be snared. These small polypi should be removed one by one by small forceps. For larger polypi, punch forceps, or broad-bladed, serrated forceps with a catch, are sometimes more suitable; but even large polypi may be most rapidly and efficiently removed by relatively small forceps which can be insinuated between the body of the growth and the nasal wall. It is essential

that the polypus should be seized as near its attachment as possible, and the growth is detached by crushing or cutting through the base with the forceps or traction and twisting, so as to avoid the risk of dragging away large portions of the bony structures. In addition to the danger of tearing away large pieces of the turbinated bones, the disadvantages of the forceps are the pain that their use involves, and the hæmorrhage. I prefer rapidly removing polypi under nitrous oxide anæsthesia, as the portion of the turbinal from which they grow can be removed with the polypus without any pain. When the middle turbinal or ethmoidal cells are the seat of inflammatory or degenerative conditions, the unhealthy structures should be clipped away cautiously with cutting forceps. Curetting the ethmoidal cells is dangerous, and **the curette should never be directed upwards**, as the cribriform plate is more readily reached and injured than is usually supposed. Bleeding generally ceases in the course of a few minutes, and may be checked by spraying with cold water. If hæmorrhage continues to be free, it may be necessary to plug the nasal passages. (See EPISTAXIS.)

Snaring is the method of removal that may sometimes be adopted with advantage, as it is often less painful and involves less hæmorrhage, but the great drawback is that the diseased tissues from which the polypi spring remain behind and require further treatment, otherwise fresh polypi grow.

Two very useful forms of snare are illustrated; in either the loop can be tightened quickly or slowly as desired, and can always be drawn out readily and re-introduced without the trouble of changing the wire.

A No. 5 to 10 steel piano-wire is generally used for the cold snare. After the application of cocaine, the nostrils being dilated by a nasal speculum, the loop of the snare, which must, of course, be large enough to pass over the whole polypus, should be introduced vertically, the upper part of the loop being insinuated between the outer wall of the nasal passage and the growth. Then, turning the snare to the horizontal, it should be passed up to the root of the polypus by gentle movements, and gradually tightened as the narrow pedicle is reached. The loop having thus been placed round the pedicle as near the base as possible, it should be tightened until the pedicle has been cut through, when the growth can be removed.

A polyp which is situated far back or has passed into the rhinopharynx often proves most difficult to snare. If it can be brought

forward by the patient blowing his nose, it may be seized with a hook or small forceps, and held while the snare is passed over the hook or forceps, and thus made to encircle the pedicle. It is sometimes possible to pass the snare with a short loop along the floor of the nasal fossa to the rhinopharynx, and then, with the aid of the forefinger in the mouth, to get the snare round the dependent growth by hooking the

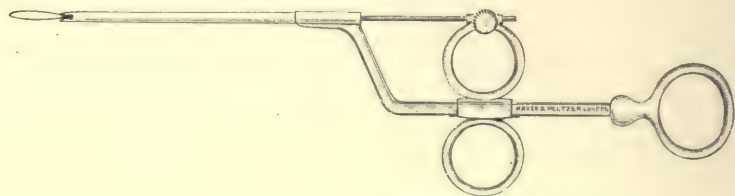


Fig. 56.—Glegg's snare.

tip of the forefinger in the loop and dragging it down until it is a large enough loop to envelop the polyp, when it is pressed into position by the finger tip. In most cases the forceps passed well back can be made to seize the pedicle, and the polypus be got rid of in this way with less discomfort to the patient.

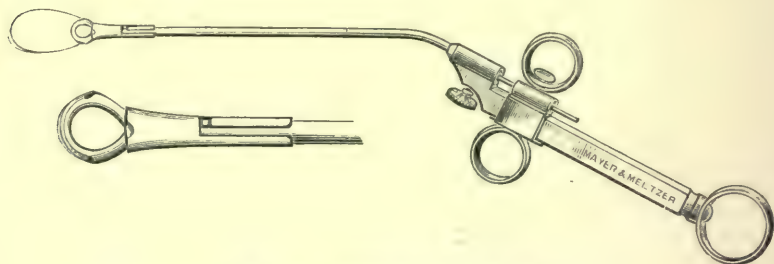


Fig. 57.—Atwood Thorne's snare.

The galvano-cautery snare may be used instead of the cold wire snare, but is sometimes followed by considerable inflammatory reaction from the unnecessarily extensive scalding of the contiguous mucous membrane as it is burning through the pedicle. For these reasons it has largely fallen into disuse, except for those polypi with thick, firm pedicles that the cold snare will not cut through.

To prevent the recurrence of the growth after simple snaring it is advisable within a day or two to deeply cauterize the pedicle with the galvano-cautery. But removal of polypi by forceps and careful clipping away diseased tissues at the base does away with any need for the cautery, and as a matter of fact I do not often use a polypus snare at all. The patient should then be directed to use an oil atomizer with some antiseptic in solution, e.g., eucalyptol or terebene, gr. x to xx to the ounce of liquid vaseline. It is essential that the patient be kept under observation for some time, as even when all growths have apparently been removed at the time of the operation, others will often become obvious in the course of a day or two after the larger mass, which has compressed or displaced them, has been removed.

Of course when the nasal polypi are secondary to, or are associated with, suppurative inflammation in any of the nasal accessory sinuses, it is essential that the implicated sinus should be treated. In most cases the ethmoidal cells are diseased, and then it is necessary to open and partially extirpate these cells in order to obtain a lasting and radical cure.

OTHER BENIGN NEOPLASMS.

The other benign neoplasms occasionally met with are :—

Angioma (FIBRO-ANGIOMA, or “Bleeding Polypus of the Septum” [Schadewalt]).—A cherry-red or mottled reddish-blue growth, varying in size from a pea to a hazel-nut, with smooth, nodulated, or moriform surface, which, with a broad, usually short pedicle, grows from the anterior lower part of the septum at a spot corresponding with the anterior extremity of the naso-palatine artery (sometimes called Kiesselbach’s artery). Occasionally they arise farther back or near the base of the septum. Three varieties are distinguished by Walliczek : (1) Granuloma type ; (2) Fibroma type ; and (3) Cavernoma type, according to the particular tissues that predominate. They bleed very readily, and epistaxis usually recurs frequently ; and when large enough they cause symptoms of nasal obstruction. It is well to remember that a sarcoma in its earlier stages might simulate a large bleeding polypus in some respects.

Differential Diagnosis.—In many cases little difficulty arises in the diagnosis of these growths, but in others it is scarcely possible to make a positive diagnosis till after histological examination of a removed fragment. Pegler, who has examined a large number of examples, and whose exhaustive review of the pathology, etc., of

bleeding polypus of the septum may be read with advantage,* states that : " If the attachment is low down towards the floor, and more or less in front, distinction has to be made from lupus or tuberculous nodules, squamous papilloma, fibroma, and the various papilliform mucous hypertrophies of the septum. I place these in what I believe to be the order of greatest similarity. Lupus and hard papilloma may be indistinguishable till microscopically examined. Fibroma is not usually so dark-coloured or vascular, but certain angeiomatous growths are not remarkably so either. The papilliform mucous hypertrophies, unless highly inflamed, are more pearly, because very œdematous. To practitioners in India, the interesting tumours resembling the fruit of the arbutus and caused by psorospermiosis of the septal mucosa, have an additional claim on their attention as not being very dissimilar in appearance to bleeding polypi, whilst occupying the same site on Kiesselbach's area. If the attachment of the bleeding polypus is higher up towards the region of the so-called tubercle of the septum, the careful use of the probe as well as the speculum is necessary to ascertain the nature and extent of the base or pedicle. Inflamed septal polypi or a pedunculated cyst must be thought of ; sarcoma and other rapidly growing neoplasms soon cause complete obstruction and often set up external disfigurement. Round-celled sarcoma—the most frequent—is soft, fleshy, and friable ; if a portion be removed the tumour bleeds violently and rapidly exceeds its former mass ; it rarely forms a succinct and pedunculated growth."

Treatment.—Thorough removal of the little growth right down to the cartilage is essential, as there is otherwise a tendency for it to recur. The cold-wire snare, used after previous application of cocaine, is a convenient instrument. The base should be cauterized and finally douched with pure carbolic acid, or the growth may be removed by a raspatory after dividing the soft tissues all round it by a galvano-cautery.

Fibroma is an exceedingly rare growth in the nose, but fairly common in the rhinopharynx. Of twelve intranasal cases occurring in the nose, collected by Casselberry, in one (his own) the fibroma was attached to the ethmoid, the others to the roof, cribriform plate, upper turbinal, and septum. They are firm, compact, painful, bottle-shaped growths, covered with smooth light pink or red mucous membrane, and are generally attached to the periosteum of the basilar

* *Lancet*, 1905, ii., 1455-1537.

process of the occipital bone, of the body of the sphenoid, of the vomer, or of the septum. As they bleed readily, in addition to the usual symptoms of nasal polypus they are attended with epistaxis. Rhinopharyngeal fibroma very rarely occurs before puberty or after the twenty-sixth year, in fact this disease is almost confined to males between the ages of fifteen and twenty-five. Lincoln, of New York, collected fifty-eight cases, all being in males under twenty-five. They are single, growing from one or other side of the basilar process or the lateral walls of the rhinopharynx. By extension upwards they may involve the sphenoidal sinus or grow into the cranial cavity, or extending forwards into the nose they cause displacement of the bones and external deformity, or displace the soft and hard palate forwards.

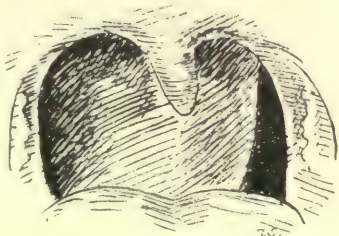


Fig. 58.—Large fibroma growing from the rhinopharynx.

Obstruction of the nasal passages, dysphagia or dyspnoea, pain, headaches, frequent epistaxis, and septic absorption lead to fatal results when the growth is unchecked in its progress. When removed in early life they tend to recur up to the age of twenty-two, but they may atrophy spontaneously in early adult life after attaining large dimensions. By early and free removal of smaller growths and cauterization of the base, it may be possible to avoid recurrence. Thus they should be operated on, if possible, when small, but even large growths should be removed, if necessary, piecemeal, and recurrences similarly dealt with; for if the patient can be tided over a sufficiently long period, the growth ceases to recur.

They may be removed by the galvano-cautery or cold-wire snare, or by electrolysis if small. Large intranasal fibroma may necessitate a Rouge's operation, or some external method of laying open the nasal passage. The author's operation, described on p. 113, gives free access to the parts right back to the rhinopharynx, and if the author's post-nasal plug can be introduced the bleeding is under control. For removal of rhinopharyngeal growths it is usually necessary to do a preliminary laryngotomy, through which anæsthesia is maintained, the laryngeal cavity being plugged above with a sponge. Hæmorrhage is often very copious, and when the growth is large it is usual to have recourse to

splitting the soft palate, and, if necessary, partial removal of the hard, to give room for the snare.

Papilloma.—The true papilloma, or papillary fibroma, occurs very rarely within the nose beyond the vestibule, but is more common in the vestibule, where it is simply a common wart, the papilloma then being covered with squamous epithelium. Within the nasal passages the typical papilloma is almost invariably attached to the lower and anterior part of the septum, but a few instances are recorded of their growing from the lower turbinal. They usually vary in size from a pea to a filbert, and are sometimes multiple, but large nasal papillomas have been described in two instances, the one removed by Logan Turner measuring $6\frac{1}{2}$ in. in circumference, and necessitating an extensive external operation. They are pink or red, soft, lobulated, raspberry-like, sessile or pedunculated growths, which are movable and bleed readily. They are papillomatous in structure, having a thickened epithelial layer of squamous or columnar epithelial cells, the central interstitial tissue being composed of connective tissue and a few blood-vessels. Sometimes they are very vascular, and have then been described as angiomata.

Papillary Myxoma, and Papillary Adenoma.—It is necessary to distinguish carefully true papilloma from Hopmann's polyp, the papillary œdematous hypertrophy of the nasal mucous membrane not infrequently associated with ordinary mucous polypi, to which reference has already been made. Glandular overgrowths, localized inflammatory thickenings, and papillary hypertrophies are fairly often found on the inferior turbinal, and also on the middle turbinal and other regions.

Symptoms are often absent until the growth is sufficiently enlarged to cause nasal obstruction; occasionally some bleeding of the growth occurs. Warts in the vestibule, if picked by the nail, may inflame and give rise to the suspicion of malignancy.

Treatment.—Papillomata should be removed by the snare or cutting forceps, or by the application of glacial acetic or chromic acid. Fletcher-Ingals has found the application of *thuja occidentalis* reduces the growths and tends to prevent their recurrence, which is very liable to arise. At any rate, the base of the growth should be galvano-cauterized to obviate this tendency.

Osteoma.—There are two varieties of intranasal osteomata, the hard ivory and the soft or cancellous, the former being the most frequent. They may grow from any part of the nose, but most

frequently they arise from some part of the ethmoid bone. Some cases appear to have been caused by traumatism, others by syphilis, but usually there is no assignable cause. As the tumour increases in size it causes displacement of the adjoining structures or obstructs the nasal passages or the openings of accessory sinuses, with consequent mucocoele or empyema, and sometimes causing the development of mucous polypi; or again, the bony growth may extend into the orbit, with displacement of the eye or occlusion of the lacrymal duct. From involvement of nerves or by extension upward through the cribriform plate, or from the intracranial surface of the frontal sinus wall, an osteoma may cause headache and signs of intracranial pressure. Bony bosses may develop on the outer surface of the nasal bones or over the frontal sinuses. An osteoma may be slightly movable, being attached by a short firm pedicle. These bony growths are sometimes described as living or dead, according as they are firmly attached or have undergone spontaneous loosening. The surface is covered with red, uneven mucous membrane. They may often be removed by forceps or snare, but sometimes come away spontaneously from atrophy of the pedicle. In one of my patients the only symptom was gradually-increasing obstruction for twelve months. The left nasal passage was completely occluded, but the anterior end of the osteoma could be seen by anterior rhinoscopy. When removed it proved to be a large ivory osteoma, 4 inches long, attached to the septum close to the nasal floor.

It is impossible to lay down directions for their removal, and sometimes extensive external operations become necessary.

Ecchondroses are very rare, occurring generally in young males on the septum, the roof, or outer wall. They may cause obstruction, catarrhal symptoms, and, if large enough, external deformity. If not too large they should be removed by the cold or the galvano-caustic snare.

Leontiasis Ossium, a disease characterized by hyperostosis of the bones of the head, may involve the nasal passages. Though generally attributed to a syphilitic infection, its actual cause remains unknown, for the evidence that it is due to syphilis is inconclusive. The disease generally declares itself between the ages of ten and thirty years, but its onset is indefinite and its progress very slow. Bony bosses, generally more or less bilaterally symmetrical, appear in the maxillary bones, causing external swelling of the cheek or lower jaw, and on the frontal and nasal bones. The progressive enlargement

of the bony excrescences may cause displacement of the eyeball, or pain from involvement of nerve trunks, and even when no external enlargements of the nasal bones have arisen, the nasal passages may



Fig. 59. — *Leontiasis ossium*, author's case, with frontal sinus suppuration.

be partially or completely obliterated by the inward extension of the thickening of the external walls of the nasal bones or the nasal processes of the superior maxillæ. Nasal stenosis and deformity are the usual result, but the nasal accessory sinuses may be wholly or in part replaced by a cancellous bone, and when a sinus, such as a frontal sinus, becomes almost shut off from the nasal passages, sinus suppuration may ensue. In one case recorded by the author (Fig. 59), this resulted in death from secondary subdural abscess in the region of one frontal lobe.

Cysts. — Besides the various forms of cystic polypi already referred to on page 99, we may

meet with cystic growths from the turbinal bodies and air-containing cavities in the middle turbinal bone. Brown Kelly has collected twelve recorded cases of cysts on the floor of the nose. The patients were all females between the ages of nineteen and fifty-eight. A swelling is first observed by the patient beneath the alæ, and then having attained a certain size, remains stationary, or rapidly enlarges and becomes painful, varying in size from an almond to a walnut, and when large causing external deformity. Kelly considers them to be retention cysts.

Hydatids and *dermoid cysts* have likewise been met with in the nasal passages, and rarely a small cyst on the anterior part of the nasal floor arises from the roots of the incisor teeth.

Treatment.—When large enough to cause inconvenience a cyst may be laid open and the cavity curetted. The polypoid retention cyst of the inferior turbinal collapses when the contents escape, and the cyst wall should, if possible, be dragged away. There is a great tendency for these cysts to recur.

MALIGNANT NEOPLASMS.

Sarcoma is rarely primary in the nose, while **Carcinoma** is extremely rare. A sarcoma sometimes takes the form of a mucous polypus, which it may so closely simulate as only to be differentiated by microscopical examination. I have known a patient with mucous polypi recurring for some years, develop nasal sarcomatous polypi, apparently an instance of the occasional sarcomatous degeneration of fibromata. The small spindle-celled growth is the most common, but the small round-celled form occurs nearly as often; other varieties have been recorded, e.g., myxo-sarcoma, myeloid sarcoma, osteo-sarcoma. Two forms of carcinoma are met with, the alveolar and the squamous.

Malignant growths are but rarely found originating on both sides, and when a patient presents growths involving both superior maxillæ, and which histologically appear to be separate sarcomatous tissue, it is probable that the growths are non-malignant diffuse osteomata such as occurs in leontiasis ossium or an infective soft fibroma. When these non-malignant growths are unilateral it may be impossible to differentiate them from true sarcoma.

Symptoms.—Primary malignant growths generally develop on the septum. Sarcoma occurs as a single, sessile, soft, lupus-like deposit, with smooth or rugose surface of pink or brown colour, rapid in growth and very vascular. Carcinoma encephaloid commences as a small wart-like growth of dark or red-purple colour, and generally ulcerates early.

A sarcoma affords more chance of radical extirpation than a carcinoma, and a fibro-sarcoma appears to be more favourable than a pure sarcoma. Sarcoma of the nose generally occurs in elderly people, but may arise at any age. Frequent and severe epistaxis associated with a sessile septal polyp is very suggestive of sarcoma in patients over forty. A case of a female aged twenty-five, presenting these symptoms, but in whom the growth extended back to the roof of the nasopharynx, is referred to more fully on p. 113.

Cancerous growths are soon attended with foetid discharge, pain, and epistaxis, and grow rapidly. The diagnosis very often must remain uncertain until a portion of the growth is submitted to microscopical examination. In the early stages, with a small defined growth, radical removal would offer a good chance of extirpating the growth. The prognosis depends largely on the degree of malignancy and the seat

of the growth, but even fairly large growths may be successfully removed by sufficiently radical operation. The difficulty of accurately estimating the extent of the growth and the limits of the deeper regions which are involved adds enormously to the difficulties of deciding the possibility of an operation proving successful. While useless operations are to be deprecated, it is better to give the patient the benefit of reasonable doubt, and to endeavour to remove a condition which must prove fatal if left to run its course, the risks involved either way being first fully explained.

OPERATIONS ON THE NOSE FOR MALIGNANT GROWTHS.

The question whether an attempt to remove the growth through the natural passages or by an external operation will be the first matter for consideration, and on this point I have no doubt that the patient's welfare is best ensured by an external operation which enables the operator to bring the implicated region into as full a view as possible. It may be conceded that good results have been obtained from curettement through the natural passages with subsequent cauterizations, but only growths very favourably situated render such success possible, and it is quite impossible to remove the whole of the growth in this way with any degree of certainty; and while waiting for later evidences of imperfect removal there is a great likelihood of the growth extending beyond all chance of any operation being successfully undertaken. Rare instances of successful removal of malignant growths from the larynx *per vias naturales* have been recorded, but the risks of failure are so immensely increased as compared with external operation that, however small and accessible a laryngeal growth may appear, such a procedure ought never to be advocated, and the same principle applies to intranasal neoplasms. Hence operation through the natural passages should be resorted to under the following circumstances only: (1) When the patient declines external operation, or the age and general condition of the patient preclude external operation; and (2) When any justifiable operation is unlikely to succeed in complete removal of the disease, and partial removal is desirable for the purpose of restoring nasal respiration.

External Operations for Malignant Growths of the Nasal Passages.—The method of operating depends largely on the seat of the growth; thus we may divide cases of malignant growths into the following groups:—

(a) Tumours of the anterior lower half of the septum, floor, and outer wall of the nose, including the inferior turbinal.

(b) Tumours of the middle turbinal and ethmoidal region, or involving the upper and middle part of the septum.

(c) Tumours of the posterior half of the nose, including the sphenoidal sinuses and post-nasal space.

(d) Tumours involving the frontal sinus or maxillary antrum.

As the bleeding is always profuse, the application of suprarenal extract and the insertion of the author's post-nasal plug (vide p. 217), or else a preliminary laryngotomy, should precede the operations now referred to.

Rouge's Operation affords good access to the anterior half of the nasal passages, and leaves no external scar. An incision down to the bone is carried along the gingivo-labial fold, extending from the level of the first molar tooth on one side to the same point on the other side; the soft tissues and the periosteum are raised from the bone, the upper lip and nose being thus detached from the jaw and pulled well up. The septum should be cut or sawn through as close to the floor as the growth allows, but, anyhow, should be divided a little distance in front of the tumour, which can thus be removed by incisions well outside the diseased area.

If more room is required, the nasal process of the superior maxillary bone can be clipped away by bone-cutting forceps. Again, if the outer wall of the nose is involved or the corresponding portion of the antrum invaded, the antral cavity should be opened by chisel or trephine, and as much of the outer wall of the nose cleared away as may seem desirable. Finally, the gingivo-labial incision having been sutured, the lip and nose should be drawn down into position and the wound packed with antiseptic gauze through the nostril for the first twenty-four hours. It is not necessary to suture the incision in the gum, but with such a long incision it is better to bring the edges into apposition with three or more sutures.

Operation by Incision along the Naso-labial Fold, which is extended right down to the bone, the lateral cartilage of the nose being cut through, and the soft tissues with the periosteum raised. The nasal bone and nasal process of the superior maxilla can be partially removed by bone forceps and give freer access to the exposed nasal passage; or a similar point of entry may be made by Langenbeck's osteoplastic flap, one incision being along the anterior border of the nasal bone near the mid line, another along the posterior

border each as far as the ala, the lower ends being joined by a transverse incision. The first two incisions are deepened, a saw or chisel dividing the nasal bone into the nasal passage, and the whole flap turned upwards, the nasal bone being dislocated from its attachment to the frontal. Subsequently the flap is turned down and sutured in position.

For tumours involving the ethmoid it is better to obtain access by an operation which freely exposes the upper part of the nasal passage to view, such as the operation of Ollier or of Moure, or the author's osteoplastic flap operation.

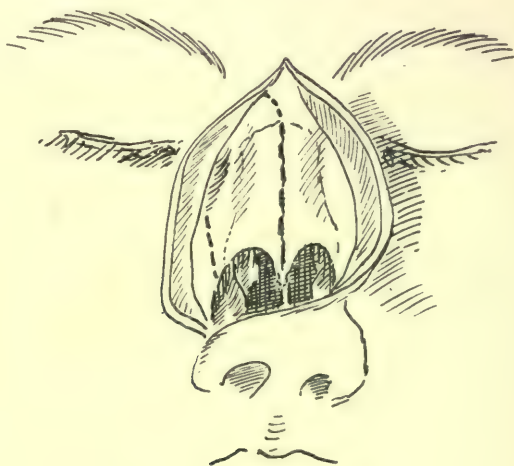


Fig. 60.—Moure's operation.

Ollier's Operation.—An incision is made extending from the lower border of the nasal bone on one side upwards to the root of the nose, thence carried across and downwards to the lower border of the opposite side, dividing all structures down to the bone. With a thin nasal saw the nasal bones and septum are divided along the line corresponding to the incision. The nose can then be turned down on the face, giving free access to the nasal cavities.

Moure's Operation.—A median incision down to the bone is made from the root of the nose to the tip of the nasal bone, thence to the alar sulcus on one side, dividing all tissues into the nasal passage. By reflecting the soft tissues and periosteum the parts are exposed

as shown in the figure. By cutting away a considerable portion of one nasal bone and of the nasal process of the superior maxilla, Moure gained free access to the upper ethmoidal region in a case of malignant disease. This region, however, can be freely exposed by the author's osteoplastic method, which has the advantage of preserving the bone and ensuring no deforming depression.

The Author's Operation.—This was devised for the removal of a sarcoma from the septum, extending about 1 inch from the left anterior nasal orifice right back to the roof of the nasopharynx, and involving the ethmoidal cells on this side. It is performed as follows: The nasopharynx having been plugged by the author's forceps sponge holder, the first incision extends down to the bone, from the root of the nose just to the left of the middle line, as far as the free lower border of the nasal bone, the incision being continued into the nasal passage. A second incision curves down from a point internal to and above the inner canthus down to the middle of the lower orbital margin, the lacrymal duct is turned outwards, and the lacrymal groove opened into the nose. A transverse incision unites the upper ends of the other incisions, the nasal bone is divided from the frontal bone by a chisel, and a fine narrow saw, passed into the left nasal passage so as to emerge at the lower end of the opening made in the lacrymal groove, dividing the nasal process of the superior maxillary bone from within outwards without injuring the overlying soft tissues. The flap of bone and underlying tissues thus formed is turned down and held aside. The septum, when involved, is rapidly removed from a little in front of the growth right back to the nasopharynx. The left ethmoidal cells and middle turbinal may likewise be cleared away back to the sphenoidal sinus, and the growth is also cleared away from the roof of the nasopharynx as in the author's case. The osteoplastic flap is finally pushed

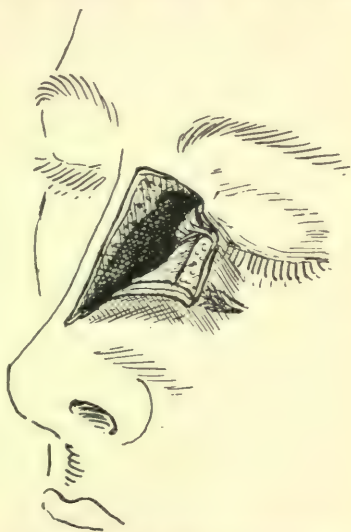


Fig. 61.—The author's operation.

back into position and sutured. The main arterial supply to the flap is not interfered with by this operation, and healing is rapid. The operation is performed by an osteoplastic flap similar to that made by the author for the fronto-ethmoidal radical operation, though not reaching so high up. The case is recorded in the *Proceedings of the Royal Society of Medicine*, 1908, vol. i, No. 9, p. 115. Recovery was perfect, without the least facial defect or deformity, and no recurrence had taken place when the patient was shown six months after operation.

For growths involving the posterior part of the nose, the author's operation, already described, may suffice. For some cases, splitting the soft palate, and cutting away as much of the hard palate as may be necessary, may be commended. Access to the posterior nasal region may be obtained by Denker's operation, figured on *Plate XL*, the septum and the antral walls being then divided horizontally, after the plan devised by Partsch. When a malignant growth involves the ethmoid region, it tends to spread to the orbital plate, with consequent displacement of the eye upwards or outwards, or it spreads upwards through the cribriform plate to the cranial cavity. If the eye is displaced inward, it points to the sphenomaxillary fossa being invaded. When any of these regions are implicated, there is hardly any likelihood of operative measures proving successful, and the same may be said of malignant growths that involve the frontal sinuses. Hence, in the case of malignant growths of the nasal cavities, a contra-indication for operation is displacement of the eye. Malignant disease of the antrum may sometimes be successfully treated by partial or complete removal of the superior maxilla.

Palliative Treatment.—With ulceration of a growth, the foetid discharge should be treated by syringing with mild antiseptic solutions, insufflations of iodoform and orthoform. In some cases of more or less localized growth, much relief may follow curetting of the growth and cauterization of the base; a method that has succeeded in keeping the development of the neoplasm in abeyance. When local recurrence takes place the involved area should again be curetted and cauterized.

TABLE FOR DIFFERENTIAL DIAGNOSIS.

<p><i>Chronic Hypertrophic Rhinitis.</i></p> <p><i>Age :—</i> Adults, especially males.</p> <p><i>Symptoms :—</i> Nasal catarrh and obstruction, discharge mucopurulent, and nasopharyngitis. No pain. Hypertrophy of the inferior and middle turbinals, especially posteriorly, where they form spawn-like masses in the choana. No ulcer, no hæmorrhage.</p>	<p><i>Atrophic Rhinitis with Ozæna.</i></p> <p><i>Age :—</i> Puberty and young adults, especially females.</p> <p><i>Symptoms :—</i> Loss of smell and intermittent discharge of intensely foetid mucus, and nasal obstruction by dry crusts; both smell and obstruction removed by cleansing. Olfactory fissure wide, bridge of the nose often depressed. Atrophy of turbinal bodies. No ulcer, no hæmorrhage.</p> <p>No destruction of bone.</p>	<p><i>Syphilis.</i></p> <p><i>Secondary :—</i>Occurs with manifestations of syphilis in other parts.</p> <p><i>Tertiary :—</i> Gumma, nasal obstruction persistent, no pain, little discharge. Is a large smooth, red, hard, and elastic tumour. It soon ulcerates, with mucopurulent discharge.</p> <p>Ulcer often longitudinal, deep, edges thickened, with pale granulations,* which readily bleed. Margins slightly raised, surrounded by areola; floor covered with pus. Not tender to touch. Does not bleed easily. Destruction of bone as well as cartilages. Syphilitic neoplasms are very amenable to treatment by internal remedies.</p>
<p><i>Tubercle.</i></p> <p>Generally associated with tubercle elsewhere.</p> <p><i>Symptoms :—</i> Nasal obstruction absent or slight. No pain. Neoplasms. Ulcers small, round or ovoid, or irregular outline, margins not raised, surrounded by pale mucous membrane, covered with greyish-white opalescent mucus-pus, surrounded by pale mucous membrane. Not tender to touch, and not great tendency to bleed.</p>	<p><i>Lupus.</i></p> <p>Generally associated with lupus of skin, in the young chiefly.</p> <p><i>Symptoms :—</i> Nasal obstruction. No pain, or only slight. Clusters of small, red, firm elastic growths of slow progress. Ulcers—margin raised, covered with crusts, tends to cicatrize, surrounded by normal mucous membrane. Bleed easily on removing crusts, and are painful when touched. Caries of soft structures only.</p>	<p><i>Benign Growths.</i></p> <p>Polypus freely movable, gelatinous, translucent, pedunculated growths from the middle or superior turbinal bodies or meatuses. Generally multiple.</p> <p><i>Symptoms :—</i> Nasal obstruction or discharge. No pain.</p> <p><i>Fibroid :—</i> A single, firm polypus or sessile growth from septum or inferior turbinal. Painful.</p> <p><i>Papilloma :—</i> A cherry red or pink moriform growth on the inferior turbinal or septum, often multiple. Painless nasal obstruction the only symptom.</p>
<p><i>Malignant Growths.</i></p> <p><i>Age :—</i> Advanced. Sarcoma at any age.</p> <p><i>Symptoms :—</i> At first nasal obstruction and epistaxis, rather than pain. Later, intermittent,</p>	<p>lancinating pain. Constitutional cachexia.</p> <p>Growths generally unilateral, single, springing from septum, are sessile, red or purple, soft, bleed on touch, not tender. Rapid growth and early ulcer-</p>	<p>ation, with discharge of sanious greenish mucus-pus, soon becoming foetid. Microscopical examination important. Ulcer deep, irregular, covered with mucopus.</p>

SECTION VII.

DISEASES OF THE NASAL SEPTUM.

PERFORATION
DEFLECTIONS
EPISTAXIS
ABSCCESS

FRACTURES
SYNECHIÆ
BONY STENOSIS OF
THE CHOANA

PERFORATION OF THE SEPTUM.

PERFORATION of the septum was found by Zückerkandl eight times in 150 autopsies, and is, therefore, more frequent than is generally supposed. In many cases it causes no symptoms and is without significance, and certainly it cannot be held that perforation of the cartilaginous septum is a proof of syphilis. The two chief sources of inconvenience are: (1) The tendency for secretion to collect and form crusts on the margins of the hole; and (2) A whistling sound during respiration if the hole is small and situated far forward; large perforations do not cause "whistling."

Etiology.—Perforation may very rarely be due to (a) Congenital defect; the majority of cases are caused by; (b) Dust and local irritation resulting in the so-called atrophic or perforating ulcer of the septum; (c) Infective diseases, such as lupus, tubercle, syphilis or, more rarely, diphtheria, typhoid fever; or (d) Traumatic causes, e.g., operative measures.

Atrophic or perforating ulcers are the result of particles of inhaled dust impinging and collecting on the septum in the lower anterior end of the cartilage. Anæmic or weakly persons are prone to suffer, and especially workers in air impregnated with irritating chrome dust. The ciliated epithelium becomes denuded by the dust, particles of which adhere, and when removed by the finger or otherwise, an abraded surface is left, on which crusts again collect until the ulcer, getting deeper, perforates the cartilage. The perforation is always limited to the anterior end of the cartilage, and, at first small, may

extend until it is as large as a shilling. Frequently epistaxis occurs as the crusts separate.

Perforations due to lupus or tubercle are usually limited to the cartilage, but tertiary syphilis involving the nose very usually implicates the bony septum.

Symptoms.—When only the cartilage is involved, symptoms are often absent; the most annoying to the patient, as a rule, are very small perforations near the anterior end, owing to their liability to whistling in forced respiration. But if the perforation involves the bony septum, fœtor is almost invariably present in very marked degree. The bridge of the nose only becomes sunken when the nasal bones are diseased. I have known the whole septum to have completely disappeared without any falling-in of the nose at all.

Treatment.—Perforations are best left untreated if symptoms are absent and there is no disease present requiring interference. When the edges of the perforation tend to crust over and ulcerate, they may be touched with strong nitrate of silver solution, or even cautiously galvano-cauterized, with a view to promoting cicatrization. If it is desired to close a moderate-sized perforation, the margins should be freshened and the muco-perichondrium raised, after making a curved, more or less vertical, incision half an inch in front of the perforation on one side, and behind the perforation on the other side. The first freed flap of mucosa is slid back over the hole and secured by suture to its posterior margin, while the other flap is slid forwards and secured to the mucosa of the anterior margin. The mucosal curtains over the perforation are kept in position by gently packing the nasal passages.

Goldstein's plastic flap method is available for larger perforations. The margins having been freshened and the mucosa all round the hole raised for a short distance, a circular flap of muco-perichondrium is raised from the septum above the perforation, being left attached above the hole: it is then turned down and the edges of the flap tucked beneath the mucosa raised around the margin of the hole.

SEPTAL DEFLECTIONS, CRESTS, AND SPURS.

Deviation of the septum in some degree may almost be regarded as its normal condition, for it is only in comparatively few persons that it is absolutely straight. Morell Mackenzie, in an examination of 2,152 skulls in the Royal College of Surgeons, found a deviated septum in 1657, or about 75 per cent. In about 40 per cent of the

cases the deviation was to the right, in 30 per cent to the left, while the remainder were sigmoid or zigzag.

Etiology and Pathology.—As regards the etiology of these deformities of the septum, there is much difference of opinion, and there is no doubt that they are due to diverse causes.

Blows and injuries are responsible for the large majority of septal spurs and deflections. Whenever one nostril is more stenosed than the other, suction force exerted during inspiration is more marked on that side. Negative pressure in this way may *increase* a deflection produced by other causes, and when one nasal passage has been rendered much narrower than its fellow, e.g., by turbinal hypertrophy, the negative pressure on that side will be greater than the

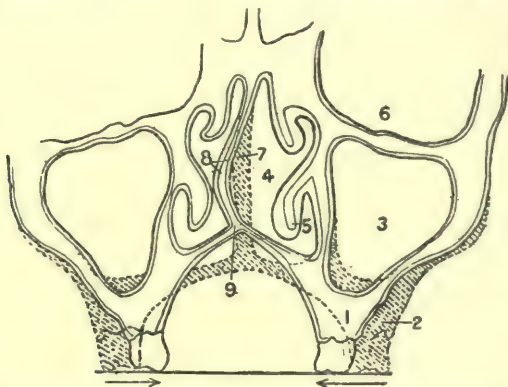


Fig. 62:—Diagram showing the formation of the high narrow palate and the deformity of the nasal septum resulting from nasal obstruction. The arrows indicate the line of action of the compressing force. (After Lambert Lack.)

other during inspiration. But as positive pressure must also be greater in the obstructed passage during expiration, it is improbable that air pressure has much to do with *causing* septal deflections. Marked deflections may be due to the pressure of large polypi in the opposite passage, and after the polypi are removed this may be obvious.

The deformity of the palate resulting from nasal stenosis, viz., the V-shaped or vaulted palate, is considered by some authorities to be a cause of septal deflections; while others consider that these septal deformities are due to the developing septum being out of proportion to the bony framework of the nasal fossæ. Probably in a certain proportion of cases these developmental factors influence the origin

of the septal defects ; but I am more and more convinced that traumatism is, even in the absence of the history of blows, by far the most frequent cause of true deflections.

Varieties.—Deformities of the septum are very variable in shape, and it is convenient for clinical purposes to recognize three chief varieties:—Deviations or deflections which are (1) **C-shaped**, as the septum may be bowed towards one side or the other, in an antero-posterior direction or in a vertical plane ; (2) **S-shaped**, where the bowing is in one direction anteriorly or below, and in the opposite direction posteriorly or above. These C- and S-shaped deflections are frequently due to or associated with dislocations of the cartilage from the vomer, and are frequently combined with the next class of ridges or thickenings along the line of such dislocation ; (3) **Out-growths, spurs, crests, or spines**. These are usually seen along the line of articulation of the triangular cartilage with the vomer, and may or may not be accompanied by actual dislocation of the cartilage. Fractures of the cartilage in a vertical direction due to traumatism, when the anterior margin of the cartilage is usually seen projecting into one or other nasal vestibule, are very frequently complicated by thickenings forming a ridge along the seat of the fracture, usually due to local perichondritis and thickening of the mucous membrane over the corresponding area. But such thickenings or ridges may arise without any deflection or dislocation of the cartilaginous or bony septum.

In other cases we find simple kinks, spurs, or rounded prominences formed by the nasal spine or vomerine ridge of the maxilla and projecting into the passage, and approaching or coming into contact with the lower turbinal.

Symptoms.—The chief are those of nasal obstruction, viz., buccal respiration and its consequences. In some cases the catarrh consequent on retained secretions behind the obstruction causes Eustachian catarrh and deafness of the corresponding ear. Again, the unobstructed nasal passage, even if normally patent, may be unequal to moistening the whole of the inspired air, and, therefore, is liable to inspissation.

It may be found that in addition to the symptoms caused by rhinitis and post-nasal catarrh, the patient is very liable to repeated attacks of bronchitis and laryngitis. As a consequence of rhinitis and the extreme irritability of the nasal mucosa set up by a septal spur, patients sometimes suffer from paroxysmal sneezing or other nasal neuroses.

Diagnosis.—This should be obvious on examination of the nasal passages. The only conditions that are liable to cause confusion are syphilitic perichondritis, and hypertrophy of the vascular tissue of the septum. The former is inflammatory, the latter is soft and fluctuating and is reduced by the application of cocaine.



Fig. 63.—Septal deflection and well-marked spur, associated with hypertrophic rhinitis, paroxysmal sneezing, and asthma.

It is important, in making an examination for septal defects, (a) To look carefully for those deflections which are situated far back and therefore involve the bony septum; and (b) To examine the upper portions of the septum. These at times cannot be observed at all before operation, if there is also an anterior deflection, but one should always endeavour to get the most complete view possible—firstly, by applying adrenalin and cocaine, and secondly, by introducing a long dilating speculum.

Very distressing symptoms may arise in cases where the nasal passages are sufficiently patent to allow nasal respiration through the lower portion of the nasal passages, but where, either owing to organic obstruction or to persistent nasal catarrh,

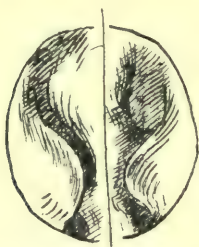


Fig. 64.—Septal deflection with nasal obstruction, due to bony prominence, in association with turbinal enlargement.



Fig. 65.—The same after cocaine has caused shrinking of the turbinals, the bony prominence and the septal deflection remaining unaltered.

the normal air tract is so stenosed as to prevent respiration along that tract.

Inasmuch as many persons who complain of no symptoms and exhibit no signs of nasal defects of any kind whatever are found in

the course of examination to have considerable septal deflections or crests, it is important in determining the necessity for interference to be guided by the presence or absence of symptoms which call for removal of the septal defect.

Treatment.—The treatment of these septal deformities is only called for when definite symptoms demand their removal, and very often they are best left alone. But when it does become desirable to rectify the defect, various methods may be considered, for no one procedure is applicable to all alike. For this reason it is necessary to dwell at some length on certain of the operations that are in vogue, although it is equally necessary to protest against the altogether undue importance that is sometimes attributed to perfectly harmless spurs and septal deflections. In a great many patients the obstructive symptoms are due to an associated hypertrophy of the inferior turbinated body, and sometimes the treatment of the turbinal hypertrophy (see p. 45), is all that is needed. But if the turbinal body is normal, it is most undesirable to relieve nasal stenosis by extensive interference with such an important physiological structure, and therefore, unless amputation of the anterior extremity is sufficient to relieve the obstructed passage, it is better to remove the deflection or spur.

Where there is only a narrow ridge, the best method is usually that of MacDonald, which is a limited submucous resection consisting in making a single linear incision over the most prominent part, well down to the cartilage. With a raspator the perichondrium, with its inseparable mucous membrane, is then turned up and down sufficiently to expose the portion to be removed. Next, the superabundant cartilage is separated with a gouge, or saw if it prove to be ossified. Finally, the flaps are allowed to fall together, and a small tampon of cotton-wool, impregnated with some antiseptic, is inserted so as to exert a gentle pressure upon the flaps, and assist in retaining them in their position. Healing should take place by first intention, and as the soft tissues are replaced after removing the spur, a perforation is avoided. Escat, of Toulouse, has succeeded in detaching the mucous membrane of the concave side by injecting sterilized water under it by means of a hypodermic syringe. He then removed the projection by means of a bistoury. De Blois strips the perichondrium and mucous membrane from the spur, saws off the spur, and then fastens down the flap of membrane by means of collodion.

These and similar restricted submucous operations, which have been in use for many years, have led up to the more complete operation of submucous resection of Freer and of Killian, which is now more generally used, not for spurs and ridges, but for most of the well-marked and extensive septal deflections.

The operation is suitable for all kinds and varieties of septal deflection, though it is not always the best procedure to adopt, as many cases are equally well relieved by simpler means, and in some cases the nasal passages would be left too patent if the septum was not only straightened but left quite thin.

Submucous Resection essentially consists in the removal of the deviated portion of the cartilaginous and bony septum, while at the same time completely preserving the mucous membrane and perichondrium, a thickened and deflected septum being replaced by one that is thin, straight, and stiff. It is thus applicable to every kind of septal deflection or spur, whether it is or is not associated with thickening of the septum, while for cases where the septum is considerably thickened it is the one method which most satisfactorily overcomes the difficulty, and ensures normal and patent nasal passages without destruction of the mucous membrane.

It is possible in persons of good nerve and considerable self-control to do this operation with local anæsthesia alone, but the long time often required to do all that is necessary makes it very trying to the majority of individuals; and the prolonged strain, even in the absence of pain, makes it preferable to resort to general anæsthesia as a rule. If one depends on local anæsthetics, cocaine, eucaïne, or novocaine can be used, and must be applied in solutions of considerable strength; but the fact that cocaine is not infrequently trying to the patient makes it the more desirable to have them under general anæsthetics whenever possible, and with general anæsthesia the post-nasal plug should be introduced. In any case, adrenal solution should be applied for at least half an hour before the operation begins, so as to cause vascular constriction, and it is important to allow sufficient time for its action.

Very good local anæsthesia is obtained by the subperichondrial injection of a 1 per cent solution of cocaine hydrochloride with equal parts of adrenalin chloride solution. Killian's needle and syringe is perhaps the best in practice, but any strong dental syringe can be used. About 2 cc. altogether should be injected beneath the septal mucosa on both sides at the spots recommended by Killian, viz.,

(1) just in front of the septal tubercle, (2) higher up and near the front of the septal cartilage, and (3) along the septal crest.

Before dealing with the septum, it is usually necessary to resect the anterior end of the inferior turbinal in the concave side; for if, as is often the case, it is so large and full as to project into the concavity, it would cause obstruction when the septum is made straight.

The incision for simple ridges and spurs should extend from behind forwards along the summit of the ridge in its whole length, turning upwards for a quarter of an inch at the anterior extremity, the subsequent stages of the operation being similar to that for general deflection.

There are *three different methods of incising the mucous membrane*: (1) The triangular J-shaped incision; (2) The single buttonhole incision; (3) The author's method of incising the mucous membrane on both sides.

J-shaped Incision.—If the variety of deflection is double-angled, with a vertical and horizontal crest, as shown in the accompanying figure, the first incision is usually made as suggested by Freer, along the angle of verticle deflection, beginning high up above the deflection, and extending right down to the horizontal ridge. Then a horizontal incision is made along the crest of the ridge, extending from the bottom of the vertical cut forwards almost to the front of the septum. This incision should cut just into but not through the cartilage, for if the mucoperichondrium be not divided, when one comes to lift the mucoperichondrium the mucous membrane alone may be separated and raised from the perichondrium beneath, instead of both being raised together from the cartilage. A triangular, anterior flap of mucoperichondrium is thus outlined, and this should be carefully reflected, and then held forward by a small pledget of wool, much care being taken to avoid perforation of this anterior flap. The mucoperichondrium is then raised below the horizontal incision by means of a suitable elevator right down to the floor of the nose. Next the perichondrium of the septum posterior to the vertical incision is lifted until the whole has been removed corresponding to the septal deflection, extending down to the floor of the nose, and if necessary to the posterior border of the vomer. In this way the

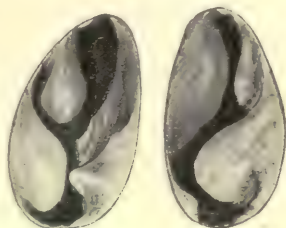


Fig. 66.—Double or S-shaped septal deflection—rectified by submucous resection, after ablation of the over-full anterior end of the left inferior turbinal.

cartilage, and where necessary the bony septum, is bared and exposed on the convex side over and somewhat beyond the whole area of deflection. Either with a round-edged chisel or a suitable septum knife, the cartilage is then incised, the incision extending *along the base*

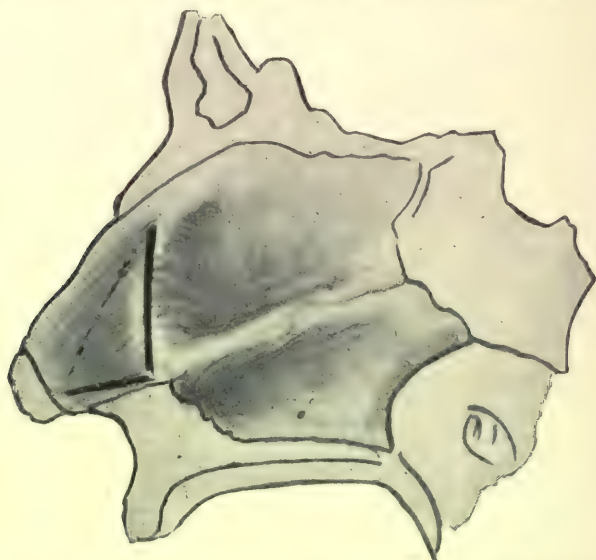


Fig. 67.—The J-shaped incision, the mucosa being raised towards the front exposing a triangular piece of the cartilage, which is cut through along the dotted line corresponding with the base of the exposed triangle.

of the triangular flap, care being taken to leave at least a quarter of an inch corresponding to the anterior free border of the septum above, in order that there may be no risk of the falling-in of the nose. The

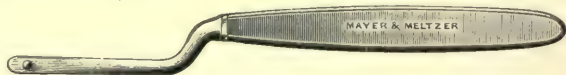


Fig. 68.—The author's nasal septum knife: the knob near the end on either side tends to prevent perforating the mucosa of the opposite side.

incision must not extend through the perichondrium on the opposite side, and in making this incision the left forefinger should be inserted into the opposite nostril, so that no puncture shall be made. The mucoperichondrium is then raised from the concave side over the

area corresponding to that alluded to in the first instance, care being taken to make the reflection right down to the floor of the nose on this side too.

The Single Buttonhole Incision may be made about a centimetre and a half behind the septum cutaneum or columella, near the floor and extending upwards and forwards, being about three-quarters of an inch long, nearly parallel to the anterior free margin of the cartilage, but curving away from it below. The mucoperichondrium is then lifted on the convex side as in the first instance, but without making any triangular anterior flap. The cartilage is next incised, the cut corresponding with the mucosal incision, yet without perforating the mucosa on the opposite side, the mucoperichondrium being then lifted from the concave side from before backwards.

The Author's Method of Incision on Both Sides.—In order to avoid any difficulty in incising the triangular cartilage in the manner described below without perforating the perichondrium, which is lying in contact with it, I first make a small incision of the mucous membrane on the concave side, *well in front* of the site selected for the usual buttonhole incision, which is to be made on the convex

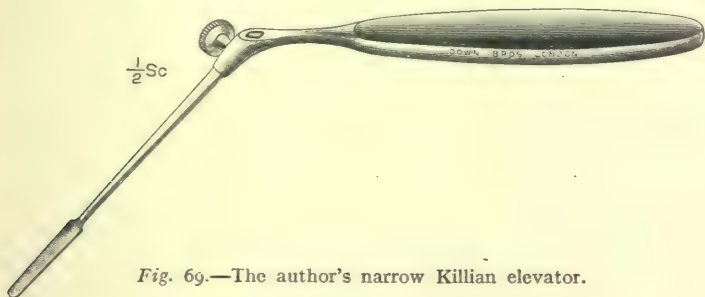


Fig. 69.—The author's narrow Killian elevator.

side. A very narrow elevator is inserted, so as to raise the mucoperichondrium, and by a movement of the distal end of this elevator upwards and downwards the mucoperichondrium is lifted from a considerable area on the concave side. (*Figs. 70 and 71.*) The elevator is then drawn out through the initial puncture, much as one would use a tenotomy knife. In this way the mucoperichondrium on the concave side having already been lifted, when the incision comes to be made in the usual way through the cartilage from the convex side there should be no risk of perforation, because the curtain



Fig. 71.—The usual buttonhole incision on the convex side. The dotted line in front shows the position of the small anterior incision on the concave side.

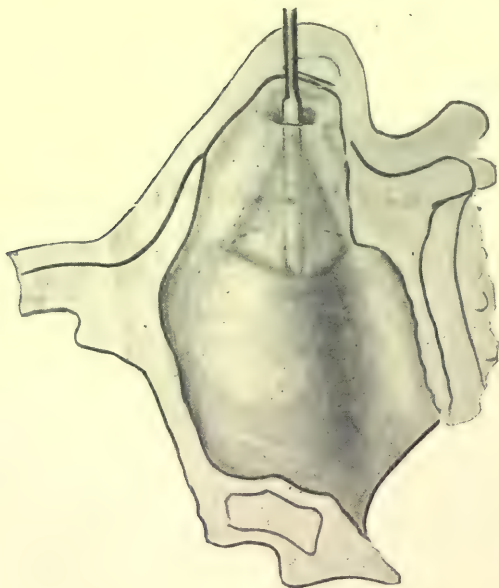


Fig. 70.—To show the author's method of making a small anterior incision on the concave side.

of mucoperichondrium on the concave side is simply pushed in front of the knife. The subsequent stages of operation are the same, whatever incision has been made. (*Fig. 73.*)

Speaking generally, the advantage of the J-shaped incision is that the incisions are made along the crests or angles of the deflections,



Fig. 72.—The author's flexible elevator: it can be bent so as to pass over and behind ridges.

and, as Freer has pointed out, it is easier to dissect the mucoperichondrium from the summit of the ridge downwards on either side than it is by incising altogether in front of it to dissect the perichondrium first up to and along the summit and downwards along the farther side. Especially is this an advantage if the vertical ridge be sufficiently near the front to be accessible. When, however, the deflections are situated well back, it is a greater advantage to utilize the

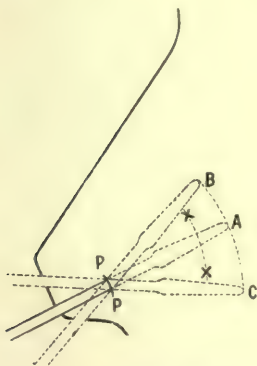


Fig. 73.

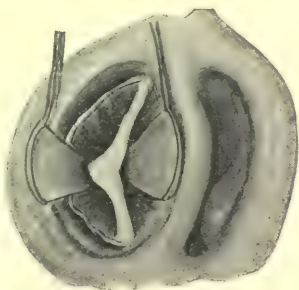


Fig. 74.—The two curtains of mucoperichondrium held apart, exposing the cartilage.

buttonhole incision, or, to my mind, the double buttonhole which I have described.

Having thus laid bare the entire area of the septum, both cartilaginous and bony, corresponding to the deflections which may extend only to the quadrilateral cartilage, or, as we have seen, occupy the

vomer and perpendicular plate of the ethmoid, it finally remains essential to remove the whole of this deflected area. If any portion of the deflected area be left above or below, although it may seem insignificant as the cause of subsequent stenosis, it becomes of importance owing to its preventing the two curtains of mucoperichondrium (*Fig. 74*) hanging vertically in apposition in the mid-line, therefore interfering with their subsequent adhesion, and also because any intervening space may become filled with blood-clot, which may suppurate or become filled up with granulation tissue, leaving a thickened or irregular septum, instead of a thin, straight septum, which is the great end of the operation. In removing the deflection.

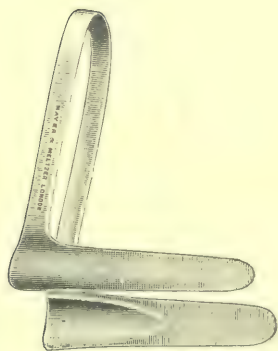


Fig. 75.—StClair Thomson's speculum.



Fig. 76.—Ballenger's swivel knife applied to the cut edge of the septal cartilage.

it is convenient to hold apart the two curtains of mucoperichondrium by means of a long speculum, such as StClair Thomson's (*Fig. 75*) or Tilley's, or one may use Killian's speculum for median rhinoscopy. The cartilage should be removed by Ballenger's swivel knife (*Fig. 76*), applying it either at the lowermost part of the cartilaginous margin, or the uppermost angle, carrying it onwards until it reaches the bony septum, then turning it upwards or downwards as the case may be, and encircling if necessary the whole of the cartilage between the maxillary crest to within a quarter of an inch of the superior free margin of the cartilage. The knife is drawn out, having cut through the cartilage, which can then be lifted out readily with forceps.

Subsequently the perpendicular plate of the ethmoid or vomer, if the seat of deflections or crests, are clipped away with cutting forceps.

The maxillary nasal spine and vomerine ridge must now be dealt with. The nasal spine may be prised away with forceps or removed by hammer and chisel, great care being taken not to wound the lower portions of the perichondrial flaps. If the ridge posteriorly is displaced

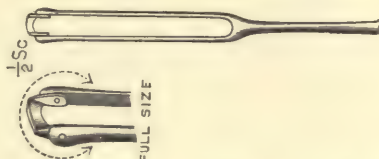


Fig. 77.—Ballenger's swivel knife, modified to hold flaps of mucosa apart on cutting the cartilage.

or thickened it is clipped away, and then it only remains to wash away the débris, bring the curtains of mucoperichondrium into position, and *lightly* pack the nasal passages on either side with strips of gauze, just sufficient to exert very slight pressure. By these means we keep the two flaps in their position, and not only ensure primary union,

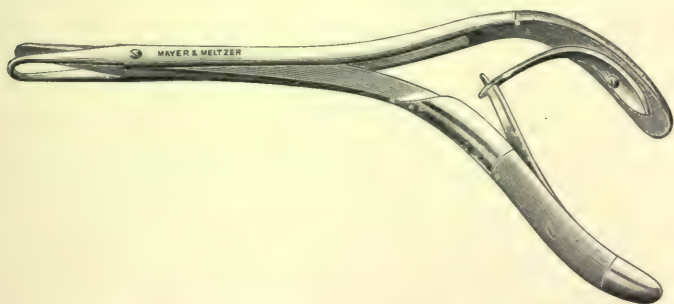


Fig. 78.—Foster-Ballenger's septum bone forceps.

but prevent the accumulation of blood between the layers, which may cause subsequent trouble by suppurating. Packing the nose, however, causes great discomfort to the patient, and by means of a special splint, such as Brüning's wire splint applied on either side, the use of packing may be obviated. The following day all packing may be removed and the nose cleansed with warm antiseptic and alkaline

solutions, which may be repeated daily until at the end of a week the parts will be healed and complete union have taken place.

The drawback to the operation, which has such eminently satisfactory results, is that it takes considerable time, and though much care and patience be observed, perforation may result. Although, if far back, this may be of no moment, when near the anterior end of the septum a perforation is prone to catch dust or form crusts, and if the perforation is only a small one, it may cause whistling sounds during respiration through the nose. Such contingencies, however, would rarely happen in the hands of a skilful operator. The operation has very rarely been followed by a tendency to crusting or inspissation of nasal secretion, possibly due to the disturbance of the mucosa interfering with its secretory activity, but I have never met with an

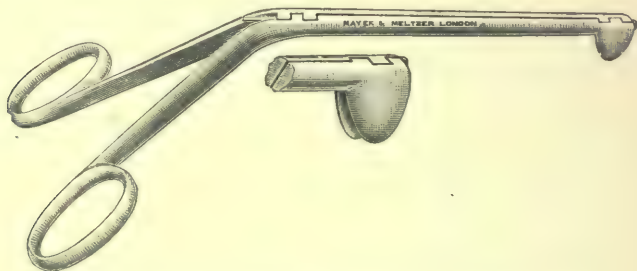


Fig. 79.—Wood's forceps for removal of maxillary crest.

instance of this crusting in my own cases, and I think that its occasional occurrence is due to overlooked ethmoidal or other sinus infection.

It is remarkable that, despite the entire removal of the cartilage between the layers of the perichondrium, which for a time will move like a curtain when touched with a probe, or even during respiration, the septum will become so stiff in the course of a few months as to give rise to the impression that cartilage has re-formed, which, of course, never can occur.

A very large number of these operations have now been done over a period of several years, and there seems to be no risk of depression of the nose externally. But in order to render this impossible, it is desirable to leave a quarter of an inch of free margin corresponding to the anterior border of triangular cartilage above the lateral cartilage. Cases have been recorded where after even a severe blow

on the nose in patients who have undergone submucous resection no deflection or depression has resulted.

How far one can wisely remove the bony or cartilaginous septum in children it is hardly safe to say without a larger number of cases before us than have yet been reported, but several instances in which quite young children have undergone the operation successfully, and without interference with their nasal development, have been reported by myself and others.

Indeed, it may be said that in children where stenosis exists nasal development would be far more interfered with if the cause be left,

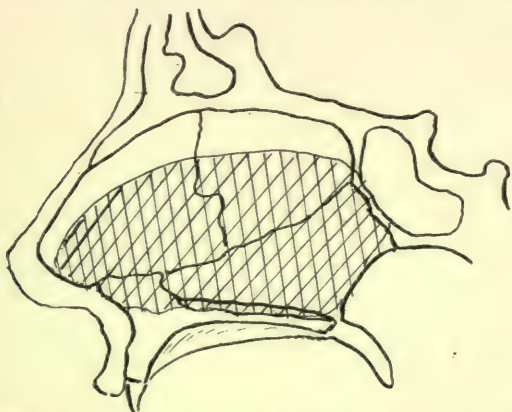


Fig. 80.—Showing the actual area of the septum removed with excellent results in one of the author's cases.

apart from all the other unfortunate results of nasal stenosis in a growing child, than could be the case from an adequate removal of the septal defects.

The Krieg-Bonninghaus Operation, known also as the **Fenster Resection**, consists in removing the whole of the cartilage or bone forming the deflection, together with the corresponding part of the mucoperichondrium on the convex side, and leaving the single bared mucoperichondrium of the concave side to form the new septum. It was originally introduced by Krieg and revived by Bonninghaus in 1900, but though still preferred by some operators, has been generally superseded by the more satisfactory, though slightly more difficult, operation of submucous resection. An **┐**-shaped incision is made on the convex side, the vertical incision in front of, and the horizontal

extending below, the whole of the deflection. The incision is made to cut through the cartilage without perforating the mucosa of the concave side, which is then raised as in the submucous operation. The deflection, together with the mucous membrane of the concave side, is then removed bodily by scissors or cutting forceps. The fact that this procedure leaves a large bare surface of the mucoperichondrium of the other side, which takes some weeks to granulate and become covered with epithelium, is a serious drawback, though the ultimate result is usually satisfactory. The operation is nearly as difficult and tedious as the submucous method, but the after-treatment

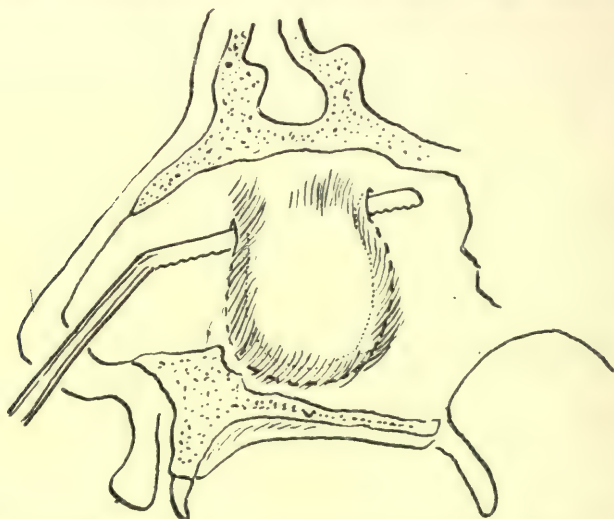


Fig. 81.—To show the method of making the flap in Gleason's operation.—W. W.

is much more tedious, and the result is not so certain to be satisfactory, and I now never have recourse to it.

OTHER OPERATIVE METHODS.—Of the numerous methods that have been advocated for the restoration of the septum, it is safe to say that many will now be relegated to the past in view of the eminently satisfactory results which can be obtained by submucous resection. Space prevents further allusion to more than a few of the chief methods now employed, e.g., Gleason's, Moure's, and Watson's operations.

Gleason's Operation can be commended where one has to deal with fairly hollow C-shaped deflections of the septum over a limited

area, restricted to the triangular cartilage, and where there is no marked thickening of the septum as a whole.

It consists in making a U-shaped flap of the deviation either by transfixing the deviated portion of the convex side by a narrow-bladed knife, which is passed through the cartilage just in front of the higher portion of the deflection, and then made to reappear on the same side by transfixing the cartilage again just posteriorly to the deflected portion, the knife being then carried vertically downwards until it is below the deflection, when it reappears ; or a saw is made to cut the deflection from below upwards with much the same result. In either case the tongue-like flap of septum, with its mucous membrane and perichondrium intact, is hanging attached by its superior border. This is then forcibly pressed through to the concave side with the finger, care being taken to overcome the resiliency of the cartilage at



Fig. 82.—The method of pushing the U-shaped flap in the septum to the concave side.



Fig. 83.—Diagram showing how the flap is automatically retained in position.

its attachment (*Fig. 82*). The oblique direction of the incision ensures that the margins of the flap extend somewhat beyond the margins of the septal incision : thus, when the flap has been pressed through, it cannot spring back again. If necessary, a splint is inserted on the concave side, sufficient to maintain slight pressure on the margins of the flap against the corresponding portions of the septum on the concave side, and this in the course of a few days results in union. In the majority of cases which are suitable for the operation the result is very satisfactory, but it is obvious that if the septum is thickened where it was deflected this thickening will be liable to cause obstruction of the formerly patent side.

Moure's Operation consists in making the incision from before backwards, along the horizontal crest or lower portion of the septal

deviation parallel to the floor of the nose, and a second incision parallel to the anterior margin of the triangular cartilage, along the whole length of the deflection above, and with the finger or suitable septum forceps causing fracture of the cartilage towards the formerly

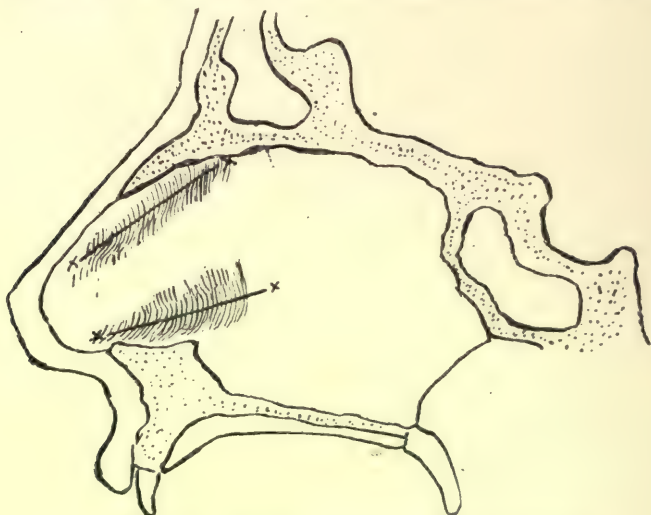


Fig. 84.—Showing the lines of incision in Moure's operation.

unobstructed side, so as to overcome the resiliency of the cartilage. The cartilage is kept in the new position by means of Moure's or other suitable nasal plugs, and these at the end of a week are dispensed with, when the union has generally taken place. In some cases it may be necessary subsequently to trim the margins. Here again it



Fig. 85.—Moure's forceps and malleable metal nasal plug.

is obvious that the operation can only be applicable to cases where there is sufficient room on the non-obstructed side to receive the deflected portion, and this can only be where deflection is simple, and has not undergone much thickening.

Watson's Operation.—When the deflection is horizontal, an incision is made on the concave side, running just beneath the angle of deflection from behind forwards to its anterior extremity, and then curving upwards for a short distance (*Fig. 86*). The knife is made to cut obliquely, so as to make a bevelled incision, but it is not carried through the mucous membrane of the opposite side, only dividing the mucosa of the concave side and the cartilage. The upper portion of this severed cartilage is then pushed over to the concave side.

When the angle is perpendicular, the incision should be made behind the angle from above downwards, and bevelled from behind forwards, and at the base or lower end of the vertical incision it is carried horizontally forward, so as to make a triangular flap. The posterior end of the anterior portion is then pushed over to the concave side.



Fig. 86.—Incision in Watson's septal operation with horizontal ridge.

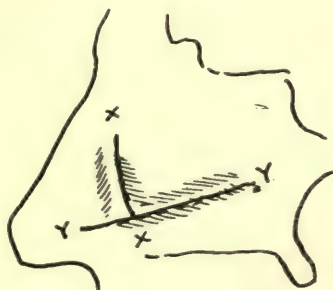


Fig. 87.—Incision in Watson's septal operation with vertical and horizontal angles.

When the deflection is compound, i.e., when there is both a horizontal and a perpendicular angle, two incisions are made meeting at the base, as shown in *Fig. 87*. The anterior triangular fragment is then pushed over so as to overlap the posterior section, and then the whole upper portion, including the anterior triangular portion, is made to overlap the basal part. In this manner one obtains a double locking, and the anterior portion is held firmly in a straight line.

If the bony septum is involved, it should be broken down with septum forceps, or if much thickened below the horizontal angle and projecting much it may be sawn off (see *Fig. 88*).

The operation is more satisfactory if the mucoperichondrium is first elevated over the area of deflection on the concave side ; as in that

case no perforation can result from the failure of the incised edges to unite in the new position. When the lower part of the septum corresponding to the maxillary crest projects after the cartilage is pushed over, the projecting ridge should be sawn off.

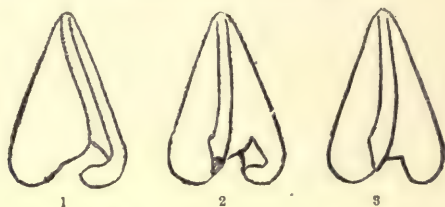


Fig. 88.—To show method of making the incision oblique, so as to ensure retention of the septum in its new position.

The advantage of these operations is that they are quickly performed, and do not call for such technical skill as is essential for successful submucous resection.

EPISTAXIS, HÆMATOMA, AND FRACTURES.

HÆMORRHAGE from the nose may be due to :—

1. *Injuries from blows, etc.*
2. *Local affections of the nasal passages, e.g., enlarged venules, erosions or ulcers near the anterior end of the septum, or there may be multiple telangiectases, or again it may be the result of simple hyperæmia, primary or secondary to cerebral congestion, or from ulceration in malignant disease, or from foreign bodies.*
3. *Systemic affections, such as anæmia, purpura, scurvy, Bright's disease, portal congestion, cirrhosis of the liver, enteric fever, measles, scarlatina, diphtheria, pneumonia, etc.*
4. *It may be vicarious and occur at the menstrual periods only.*
5. *Sudden changes in barometric air pressure, e.g., in mountain ascents, ballooning, diving, etc.*

Sources of Epistaxis.—(a) The hæmorrhagic spot is most frequently at the anterior inferior part of the septum, corresponding to the terminal branch of the artery to the septum; but when from this source, bleeding is rarely so profuse as to be dangerous. The bleeding may be a small or a copious oozing from dilated venules, or a pulsating stream from the arterial branch; or again may be due to the erosion of an ulcer. Often the source of a bleeding which for the

time being has ceased may be detected by a minute blood-clot occupying the site of hæmorrhage.

(b) The bleeding point may be at any part of the nasal fossæ, or there may be general oozing from numerous points, as is usually the case in epistaxis due to purpura, hæmophilia, and toxæmic conditions.

(c) In a third class, to which Brown Kelly has directed attention, the site of the bleeding is from the upper and anterior region of the nasal passage, above the middle turbinal. These cases, he believes, are due to rupture of the anterior ethmoidal veins. The hæmorrhage may be profuse and fatal. Kelly points to the distinguishing feature of the anterior ethmoidal veins, viz., their close connection with the intracranial circulation, which would explain the profuse and prolonged epistaxis in these cases.

If the bleeding is from the anterior part of the passages, the blood escapes from the anterior nares; but when it is more deep in origin it passes into the nasopharynx, and may be swallowed and subsequently vomited in large quantities, or it may pass into the glottis and be coughed up, and thus simulate hæmatemesis or hæmoptysis.

In some cases dependent on general conditions, e.g., plethora, portal congestion, or renal disease, the loss of blood is beneficial within limits, but when it is persistent or profuse it is necessary to check it.

The possibility of a post-nasal source of epistaxis should not be forgotten, e.g., adenoid growths sometimes bleed freely.

Treatment.—Epistaxis in young persons may be beneficial in moderate amounts, but if it is considered that the blood flow ought to be stopped, the patient should not lie down, but sit quietly in a chair with the head slightly inclined forward so as to prevent the blood flowing backwards, the neck being freed from constriction by collar or garment. Cold douches or ice-cloths applied to the back of the neck and nose are helpful, and their action is further aided by placing the feet in hot water. If these simpler domestic methods have failed, the bleeding point should be sought for. If in the anterior part of the septum, simple compression of the alæ with the finger and thumb may suffice to stop it, or the bleeding point may be touched with the galvano-cautery at a black heat. Kelly finds that epistaxis from the region of the anterior ethmoidal vessels is easily checked by firmly packing between the septum and anterior half of the middle turbinal a strip of gauze reaching to the roof of the nose, or as near it as possible; the parts below may be left free for respiration.

For a less-defined or a more deeply-seated source of hæmorrhage,

cold or iced salt and water douches may be tried, or a spray of hazeline. For general oozing, an insufflation of some astringent preparation, e.g., powdered tannic and gallic acid in equal parts, is effectual. When other means have failed the nose should be plugged. For this purpose the best thing is Cooper Rose's inflating plug; or a Bellocq's sound or a soft rubber catheter can be passed through the nasal passages till the end appears in the pharynx, when it is seized with forceps, drawn into the mouth, and the post-nasal plug of antiseptic absorbent wool or lint (about the size of a walnut) is tied on. The plug is then drawn into place till it has occluded the posterior orifice of the nasal fossa on the corresponding side, and the plugging is completed from the front in the usual manner. No plug should be allowed to remain in the nose for more than twenty-four hours. It always gets foul, and if necessary to continue it, it should be removed, and the nose, after being cleansed, re-plugged. Obviously any existing systemic condition that may conduce to epistaxis will receive due care and attention to prevent recurrence.

HÆMATOMA AND ABSCESS.

Following injuries to the nose we sometimes find, on either side of the septum, a dark red or purplish swelling of fluid blood effused beneath the mucous membrane. In course of time the blood may undergo absorption or organization, or it may degenerate, forming an abscess, which may become very chronic.

Abscess of the septum is usually the result of trauma, but in rare instances has been due to erysipelas, enteric, typhus fever, or small-pox, or it has been the result of infection from sinus suppuration.

It is well to be cautious in promising that no external deformity will ensue, for in course of time, when the inflammation and the effused blood become absorbed, the nose may develop an unsightly depression near the tip, either the direct result of injury, which may not have been apparent shortly after the injury was inflicted, or from the injury to the septum being followed by imperfect subsequent development.

A blood-tumour, if small, may become absorbed, but if large the blood should be evacuated and the nose kept aseptic by suitable sprays or lotions. Abscess of the septum should of course be evacuated, and appropriate after-treatment adopted, special care being taken to keep open the incision till all suppuration has ceased.

FRACTURES, INJURIES, ETC.

The nasal septum is mainly formed by the triangular cartilage, the perpendicular plate of the ethmoid, and the vomer: any of these structures may become fractured or dislocated, according to the nature and severity of the injury, generally due to a blow, a fall, or the entry of some sharp-pointed body.

The **Cartilaginous Septum** is the most liable to **Dislocation or Fracture**, with consequent lateral or downward displacement. Epistaxis generally occurs, and hæmatoma very often. The latter is nearly always bilateral, the blood-tumour communicating through the fissure of the fracture. The symptoms of displacement, e.g., nasal obstruction, may only become obvious after the concomitant injury and swelling have disappeared. Hæmatoma and its ultimate consequences have been referred to already.

Fractures of the Ethmoid Plate, fortunately rare, are apt to be grave, because they are seldom caused, except by violence so considerable that not only does the external bony framework of the nose suffer, but the cribriform plate is often fractured too. Such injuries involving fracture of the base of the skull are naturally very liable to be fatal.

The **Vomer** is rarely fractured, the chief symptoms being epistaxis and septal displacement low down and far back.

Treatment.—The septal fragment, if displaced, should be restored by introducing broad blunt forceps, one blade into each nasal passage, and carefully manipulating; or, when necessary, depressed fragments may be raised by a blunt probe, or sound, or by a little finger in the nasal passage. To retain the fragments in position, Mayer's or some suitable intranasal plug, or a piece of thick rubber tubing, may be required till union occurs. For external fractures the treatment will, of course, vary with the resulting deformity. Depression or twisting of the spines of the nasal bones might be rectified by subcutaneous division of the bone and careful retention of the parts in good position till reunion has occurred. When the defect is mainly cosmetic and consists in depression of the bridge of the nose, injection of hard paraffin or some other method will produce good and lasting results (see p. 148).

SYNECHIÆ.

Synechiæ, or adhesions between the septum and the turbinated bodies, may develop as the result of ulceration on apposed surfaces.

More frequently they are due to unskilful cauterization, or as a consequence of operations which allow denuded surfaces of the septum and turbinated bodies to unite. Small bridges may cause no difficulty or obstruction, but sometimes they are a source of considerable inconvenience. They should be divided and the septum kept from contact with the bare surface on the outer wall until epithelialization has occurred. This is best accomplished by the insertion of a thin celluloid or guttapercha plug, which may be removed every day or two for cleansing.

More extensive cicatrization should be transfixed with a narrow-bladed knife and flaps formed as shown in the diagrams, the flaps

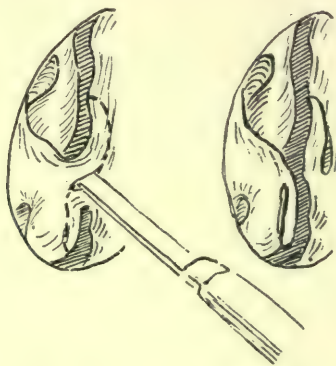


Fig. 89.

Fig. 90.

Fig. 89.—Transfixion of a cicatrix and formation of flaps.

Fig. 90.—The flaps turned up and down.

being kept in their new situation by plugging the nose until healing has occurred.

Congenital Bony Occlusion of the Choanæ.—For the treatment of this condition, described on p. 8, complete removal of the occluding partition is required, together with removal of the posterior quarter or half inch of the bony nasal septum. There is always a great tendency for the partition to reform, and I know of no way of preventing this unless the corresponding portion of the nasal septum is removed at the same time. A sharp chisel or bent knife readily cuts through the thin bone, and the part behind the incision is then clipped away with a septal cutting forceps.

SECTION VIII.

FOREIGN BODIES IN THE NASAL PASSAGES.

FOREIGN BODIES
RHINOLITHS

PARASITES

FOREIGN BODIES.

VARIOUS foreign bodies, such as small pebbles, buttons, beans, pips, and pieces of slate pencil, are found at times in the nasal passages. Of course, if the patient is brought with the statement that some such body has been pushed into the nose, the diagnosis is easy enough, but very often months or years have elapsed, and meanwhile granulations may have sprung up from the irritated mucous membrane, concealing the foreign body, while the patient has completely forgotten having pushed it in, or it may have reached the nose in vomiting.

Vomited matter which has entered the nose, or a forgotten plug introduced to control epistaxis, may cause symptoms long after its introduction. Rarely, a tooth erupts into the nasal cavity and constitutes the foreign body.

The usual symptoms are obstruction in the implicated passage and *unilateral* mucopurulent discharge, which is often fœtid and sometimes streaked with blood from ulceration or from the exuberant soft granulations that not infrequently conceal the body from inspection.

The conditions with which a foreign body may be confused are accessory sinus disease, malignant disease, osteoma, ozæna, lupus, tubercular disease, caries, and post-nasal adenoids.

Treatment consists in removal by means of forceps, a bent probe, or other means which may suggest themselves in any particular case. It is often necessary to employ some cleansing and antiseptic spray or douche after removal of the foreign body, and to treat the local inflammation which it may have caused.

RHINOLITHS.

(Syn. NASAL CALCULI; NASAL CONCRETIONS.)

Any foreign body lying in the nasal passages for a lengthy period is liable to become encrusted with calcareous matter and form a rhinolith. The presence of micro-organisms appears to be one factor in their causation, by attracting the lime-salts of the nasal secretion. In many rhinoliths no definite nucleus can be found, but in these it has usually formed round a nucleus of blood or mucus. Women seem more liable than men to develop rhinoliths; thus Seeligmann, in a collection of 110 cases, found that 62 were in female patients and 29 in male, the sex not being recorded in 9. The suggestion that the gouty diathesis is an etiological factor has little foundation except in so far as a deposit of biurate of soda, an exceedingly rare possibility, might form a nucleus.

The **Symptoms and Treatment** are practically the same as in other inert foreign bodies, extraction of any but the larger calculi being made by forceps. The larger calculi may have to be crushed or nibbled away. After removal a simple alkaline antiseptic wash should be ordered for a time. They sometimes reach an enormous size, especially in tropical climates; thus Headley reports one which weighed 720 gr. They consist chiefly of carbonate and phosphate of lime, with about 30 per cent of organic matter. The colour of a rhinolith varies from a dirty grey to brown, greenish-brown, or black, the surface being sometimes fairly smooth, sometimes rough and corrugated. Often they are soft and easily crumbled, but may be quite hard, especially near the surface, and in section they are generally found to consist of concentric lamellæ deposited around a nucleus, like a urinary calculus.

The **Diagnosis** is made by the observation of an obstructing mass in the nasal passage, which to the probe is hard and grating, and obviously bare unless its presence has caused granulations to form around it so as to more or less completely embed it. There is no foul objective stench as with necrosed bone, though the patient usually complains of a smell, cacosmia.

PARASITES.

Various living creatures and fungi are found at times in the nasal passages, such as earwigs, centipedes, leeches, ascarides, *oidium albicans*, *aspergillus*, and they may give rise to considerable

irritation and some rhinitis; but there is one affection which is particularly confined to tropical climates, in which the nasal passages are infested with maggots, the larvæ of the screw worm, *Sarcophaga georgina* or *Lucilia hominivora*, the affection being known by the name "peenash."

"Peenash" usually attacks those who are affected with ozæna or catarrhal rhinitis. The symptoms are intense irritation of the nose, with agonizing pain there and in the frontal region. There is profuse sanious mucopurulent discharge from the nose, with quantities of maggots escaping by the anterior and posterior nares, and sometimes from the ears. The subcutaneous tissues become inflamed and œdematous; generally symptoms of encephalitis supervene and the patient dies comatose. The prognosis is always grave.

The only treatment which offers good prospect of cure is the injection of pure chloroform into the nasal passages under the influence of an anæsthetic. If the maggots infest the nasal passages only, there is a prospect of cure; but when the accessory sinuses or the subcutaneous tissues were infiltrated, Kimball found that even 50 per cent of carbolic acid and 1-500 solution of perchloride of mercury useless, while oil of turpentine only killed a few of the maggots. He advises the use of carbolized oil injections to relieve pain after the injection of pure chloroform. When the larvæ or screw worms, or other parasites, gain access to the accessory sinuses, the symptoms resemble those of sinusitis; in fact, acute or purulent sinusitis is liable to be set up. The treatment then usually involves opening into the affected sinus and injecting chloroform or some strong germicide.

SECTION IX.

EXTERNAL DEFORMITIES OF THE NOSE.

VARIETIES
EXTERNAL OPERATIONS

INTRANASAL OPERATIONS
PARAFFIN INJECTION

EXTERNAL DEFECTS AND DEFORMITIES.

THE Causes of external nasal deformity are :—

1. *Congenital or developmental defects.*—(a) Saddle nose, or the broad flat nose, notched nose, in which a deep depression exists near the tip of the nose from defective approximation of the nasal cartilages or a depression corresponding to the bridge owing to congenital absence of the maxillary spine, etc ; (b) Humped nose, i.e., an exaggerated aquiline nose ; (c) Crooked nose, generally due to septal deflection ; (d) Hooked nose, and other purely cosmetic defects ; (e) Collapse or defective development of the alæ.

2. *Traumatic defects.*—(a) Depression below the bridge due to fractures of the nasal spine, and crushing in or dislocation of the triangular septal cartilage ; (b) Depression of the bridge, due to fracture of the nasal bones, which are driven back, usually the fragments overriding, so as to cause a hump on the outer side of the nasal bones ; (c) Lateral deflections of the nose ; (d) Loss of substance due to cuts, burns, or other causes, destroying the nasal tissues in greater or less degree.

3. *Pathological defects.*—(a) Saddle-nose, due to congenital or acquired syphilis ; (b) Loss of tissues in the alar region, usually due to lupus, more rarely to syphilis ; (c) Collapse of the alæ due to adenoids or other causes of nasal obstruction ; (d) Rhinophyma or fibrolipoma.

Treatment.—Recent fractures of the nose, resulting in deformity, should be treated by manipulation of the parts into their normal position, and if necessary, keeping them in position by internal packing or external strapping. Many old-standing deformities due to accident, in which the parts are merely displaced without loss of tissue and free from disease, can be removed by refracturing the nasal bones or other badly-united structures ; when the nose is made pliable,

it should be moulded into the right position, and, by intranasal splints or packing, retained in the correct position till reunion has taken place. But often it is impossible to obtain good results by such relatively simple means, owing to the formation of humps or bosses from the overriding of the nasal bones on the nasal processes of the maxillary bones, or from the effects of the accident on the bony or cartilaginous septum; then the relative advantages of various special operations may be considered.

The choice of operation must naturally depend on various circumstances, more particularly on the nature and extent of the defect in any given case. Intranasal methods have the advantage of leaving no scar when successfully performed, a point of considerable importance, but in many cases nothing short of an external operation is possible, and as unforeseen accidents and complications due to the operation itself are sometimes more likely to arise after intranasal than after external operation, the patient's advantage may be better served by external methods, which, if the tissues are healthy, should leave no obvious scar. Even when the nose has been vertically split and the nasal bones sawn through into the nasal passages, turned out, and replaced, as in the author's osteoplastic operation for fronto-ethmoidal sinus suppuration (*vide Plate XVII*) the nasal scar is rarely visible unless carefully sought in a bright light, and as it is easier to be sure of perfect asepsis with external wounds not communicating with the nasal passages than when the operation field is approached from within the nasal passages, the advantages of internal methods over external are not so great as might be supposed.

EXTERNAL METHODS OF OPERATION.

HUMPS may be removed by a vertical mesial incision through the skin and periosteum. The hump is exposed by reflection of the skin and periosteum, the bony boss chiselled or sawn off, and the edges of the skin, soft tissues, and periosteum carefully approximated and retained in position by strapping, or by fine horsehair or catgut sutures, which should be removed about the third day.

DEPRESSIONS BELOW THE BRIDGE are overcome by different methods of procedure, of which the following may be cited:—

Ouston's Operation.—A tenotome is introduced subcutaneously through the nose at the site of the depressed nasal cartilages, and divides the structures uniting them posteriorly with the nasal bones and the nasal processes of the maxillæ, and at the same time is carried

through the nasal septum at the level of the posterior border of the lateral cartilages, the septum being divided to an extent corresponding to the length of these cartilages, so that the whole of the structures of the depressed portion of the nose can be easily lifted by the transfixing



Fig. 91.—Ouston's operation completed.

tenotome to the normal level. A strong needle is next made to transfix the nasal bones as near as possible to their median suture, this being easily effected by means of sharp taps with a mallet. Another needle is made to transfix the nasal cartilages and soft tissues corresponding to the site of depression and near its upper limit. Strips



Fig. 92.—The pins used in Ouston's operation. Actual size.

of gauze are then wound round the needles on either side, in a figure-of-8 manner. The upper needle, firmly embedded in the nasal bones, acts as a fixed point, and on tightening the strips the lower needle, carrying the depressed structures before it, is lifted upwards

and forwards, thus rectifying the deformity. The parts should be firmly reunited in position in about ten days, when the needles should be cautiously withdrawn.

INTRANASAL OPERATIONS.

For a *depression below the nasal bones* due to displacement of the cartilaginous septum, the method adopted by Goodale may be commended. An incision was made through the triangular cartilage about 1 cm. in front of its articulation with the perpendicular plate of the ethmoid and parallel to it, extending from the skin above to the vomer below; a second incision parallel to the first was then made through the cartilage about 1 cm. behind the tip of the nose; the inferior extremities of these incisions were then connected by a third incision running parallel to the upper border of the vomer. A quadrilateral flap of cartilage was thus produced, adherent only above to the mucous membrane and fascia corresponding with the external depression. The flap was slid upwards and forwards till the skin of the depression was lifted up to its proper level, and then held in position by gold-plated pins transfixing it and the adjacent septum on each side in an antero-posterior direction, the pins being removed after three weeks, when the bridge was firm. Although it caused no discomfort, Goodale's patient, of course, had a perforation, which could be avoided by the more recent method of elevating the mucous membrane and making a longitudinal incision in the mucous membrane on each side, one a quarter of an inch above, and the other the same distance below, the line of incision of the cartilage.

Roe's Subcutaneous Plastic Method consists in introducing a narrow-bladed knife through the nostril till it reaches the lower border of the nasal bone. The mucous membrane is then incised and the blade of the knife passed between the skin and bone so as to separate the soft tissues from the bone and periosteum over the whole implicated region. Then a narrow fine-toothed saw is made to cut through any deforming boss, and the removed portion is worked up to fill the depression. Every precaution is taken to render the nasal passage aseptic before the operation is begun, and to keep the parts operated on aseptic. Roe emphasises the necessity for good judgment in the selection of cases for which such a method is suitable, and for care and patience in carrying it out, for if too much tissue is taken from any particular part a depression results, and if too much is put in the depressed area a hump would be felt; and

finally, the skin must not be injured, or a scar or redness of the skin may remain.

For *collapse of the alæ nasi* too pronounced for respiratory exercises to influence, Lambert Lack devised a modification of Walsham's operation, and the result was good in his case of extreme collapse with long slit-like nostrils. "An L-shaped incision was made through the mucous membrane on one side of the nasal septum, and the mucous membrane detached from the cartilage. A small piece of mucous membrane at the top, and extending a little on to the outer wall of the nostril, was then cut away so as to leave a bare surface to which the cartilaginous flap could become adherent. The knife was then passed completely through the septum, and a small quadrilateral piece of the septum, with the mucous membrane on the opposite side left intact, was cut. This flap was about half an inch long and an eighth of an inch broad. It was fixed to the roof and outer wall of the nostril with a single stitch. A similar piece was then turned up on the other side."

Paraffin Injection.—The correction of nasal deformities by the use of paraffin has been extensively practised, more especially by Walker Downie in this country and by Harmon Smith of New York.

Harmon Smith collected 1252 cases, and reported 200 cases of his own, making 1452 in all, with 1198 successful results and 106 unsatisfactory, two of which resulted in blindness, 55 in sepsis and extrusion of the paraffin, 22 in the paraffin lodging in the wrong place, and in 7 it shifted after operation.

The selection of the paraffin is a matter of importance, but opinions differ as to the relative value of hard and soft paraffin, and whether it should be injected warm or cold. On these points Harmon Smith states that "the desirable substance is one with a melting-point sufficiently high to reduce globular formation when injected to a minimum, and yet not sufficiently hard to produce inflammatory conditions by constant irritation of the subcutaneous tissues. The permanence of the paraffin in the tissues depends upon the melting-point of the paraffin and the state at the time of injection. The colder the paraffin at the time of injection, the more lasting it will be in the tissues, and likewise the better the anchorage insured." Harmon Smith recommends paraffin made of hard and soft paraffin with a melting-point of 115° F., and the author has also used the same paraffin with exceedingly satisfactory results. The skin should

be carefully prepared and rendered as far as possible aseptic beforehand, and it is safer to inject cold solid paraffin than in the liquefied state.

But many operators inject the paraffin liquefied by warming. Downie always melts it and uses a special needle heated by an electric current to keep the paraffin melted, as the wax cools so quickly that there is always a tendency for it to solidify as it runs down the needle. Harmon Smith till recently used paraffin with a melting-point of 110° F. introduced while liquefied. Gersuny, who originally introduced the method, uses a wax with a melting point of 35° – 40° C., which at ordinary temperature is of about the consistency of butter, and he prefers this to either harder or softer varieties, and it does not require to be heated before using.

If Gersuny's soft wax or a wax liquefied by heat is used, an ordinary hypodermic syringe may be employed, or by preference Downie's or Lake's syringe, which tend to keep the wax liquid in the needle; but if introduced in the solid state, Mahu's, Killian's, or Pfau's syringe, or some such specially devised syringe, is necessary. I generally use Mahu's syringe, with wax of a melting-point of 115° F. injected cold, as I think it is probably safer than the liquefied paraffins.

The needle must be directed from above downwards and made to puncture the skin near the mid-line, the point being pushed subcutaneously to the centre of the most depressed area. The injected paraffin should be moulded by the operator's fingers as soon as it enters the tissues. Only small quantities should be introduced at any one time; care is required on the side of injecting too little rather than too much, as it is always easy to inject more after sufficient time has elapsed to allow the tissues to regain their normal state; but it is very difficult indeed to remove any excess after injection. Moreover, if too much is introduced at one time there is an increased risk of the surrounding tissues being irritated, or suppuration, and migration is sometimes attributable to too much paraffin being injected under undue pressure.

During injection the root and sides of the nose should be firmly compressed by the fingers of an assistant, so that none of the injected substance can escape upwards on the forehead or laterally to the eyelids.

When sufficient paraffin has been injected, a stream of cold water should be poured over the surface of the region involved to ensure

the paraffin setting before withdrawing the needle, and thus obviate the escape of any paraffin through the track of the needle, the puncture being closed with collodion or celloidin.

Cicatrices make it difficult or impossible to introduce paraffin and retain it at the right spot unless they are raised by a tenotomy knife two days before the paraffin is injected.

Harmon Smith advises that no syphilitic, diabetic, or nephritic patient should be injected without due consideration.

Rhinophyma or Fibrolipoma Nasi.—Lipoma is a less common form of growth on the exterior of the nose than it is intranasally, and generally is largely composed of fibrous tissue, forming more or less pendulous masses growing from the alar regions and the lower end of the nose, a condition termed rhinophyma. When these give rise to disfigurement sufficient to call for treatment, the deforming mass should be shaved off, for it is seldom possible and never necessary to save the skin. One should avoid removing too much so that, when the bared surface epithelialises over, the normal contour of the nose is preserved.

SECTION X.

NASAL NEUROSES.

OLFACTORY NEUROSES

SENSORY "

VASOMOTOR "

REFLEX NEUROSES

HAY FEVER

ASTHMA

OLFACTORY NEUROSES.

ANOSMIA, HYPEROSMIA, PAROSMIA, CACOSMIA.

ANOSMIA and Hyposmia.—For clinical convenience it is usual to include under the terms *anosmia*, persistent loss of smell, and *hyposmia*, partial loss, from whatever cause, whether due to local conditions of the mucous membrane or to impairment of the peripheral or central nerve structures. For the proper perception of odours it is essential that the odoriferous particles be able to reach the mucous membrane of the upper part of the nasal passages, and that these should be in a moist condition. Therefore any **local affections** preventing respiration through the nasal passages, or deposits of mucus and secretion on the olfactory mucous membrane, or a permanently dry condition of the membrane, will interfere with or completely abrogate the sense of smell. Acute and chronic catarrh, and mucous polypi, are common causes of anosmia.

Anosmia may result from congenital absence of pigment in olfactory nerve cells, as in albinos, or from the terminal filaments of the olfactory nerves being altered or impaired, either from a chronic local inflammatory affection, or from atrophic rhinitis, or as the result of injecting very irritating sprays or douches. Injuries to the nerves from blows, fractures of the cribriform plate, peripheral neuritis in infectious diseases, particularly influenza, are among the **peripheral causes** of anosmia.

Central nerve lesions may cause anosmia; thus it may occur in

hysteria, locomotor ataxia, general paralysis, or from basilar meningitis, syphilis, aneurysms, and exostoses affecting the olfactory bulbs. Intracranial tumours implicating the olfactory lobes and growths destroying the cortical centres for olfaction or their nerve fibres to the lobes, particularly lesions of the horn of Ammon, the hippocampus and the island of Reil (Lermoyez) are other causes, but it is only very rarely that tumours or intracranial hæmorrhages produce anosmia, as it is unlikely that both bulbs would be destroyed. A few cases of unilateral anosmia, *hemianosmia*, in hysteria and from unilateral destruction of the olfactory bulb, are recorded.

Reflex anosmia has been observed to follow removal of both ovaries. The term "essential anosmia" has been applied to cases in which no local cause or lesion whatever is present to cause it. It is then usually associated with anæsthesia of the nasal mucosa.

Hyperosmia.—Increased sensitiveness to smell is sometimes found in hysteria, neurasthenia, and hypochondriasis, or it may be due to irritation of the olfactory lobes from various causes.

Parosmia, or perversion of the sense of smell with imaginary or subjective perception of odours, is nearly always central, and may occur in hysteria, hypochondriasis, in epileptics, in lesions of the anterior lobes, and in insanity.

Cacosmia, the perception of a bad odour, though generally objective and due to a foreign body in the nose or to accessory sinus disease, may be subjective, and either functional or due to central nerve disease, e.g., cacosmia in nasal crises of tabes.

Patients with unilateral anosmia do not generally perceive the loss of power of smell, and when it is bilateral they mostly complain of loss of taste. In testing the sense of smell it is important to use an odoriferous substance which is non-irritating to the nerves of ordinary sensation, and some well-known smell, such as musk, rose, etc.

Prognosis in anosmia depends (a) on the nature of the lesion, and (b) on its duration. When due to some cause which can be removed, such as polypi, or to hysteria or to peripheral neuritis, the prognosis is favourable provided it has not persisted for a long time. But when the cause is some central lesion or a destructive local lesion, recovery is improbable.

Treatment consists in the removal of the local cause when possible. Local injections of strychnine, local galvanization, the administration of arsenic and strychnine, and general treatment of any neurosis are the most that can be done.

SENSORY NEUROSES.**HYPERÆSTHESIA, ANÆSTHESIA.**

We have already noted the anatomical association of the nasal nerve supply (see p. 34) with the vagus nuclei in the bulb and with the sympathetic, and there is ample evidence also of a close relationship between the nasal passages and the sexual organs, to which fuller reference will be made; hence a number of affections are instances of true nasal neuroses. Nevertheless, it is important to avoid referring neuroses to a nasal source whenever it is possible to detect some slight anatomical defect in the nose or to excite a physiological reflex in response to local irritation by a probe. Each case in which an intranasal cause for an existing neurosis is suspected must be judged on its merits, and, without unduly underestimating any local lesion, it is well to bear in mind that the victim of neuroses of any kind is apt to lead the unwary practitioner astray and to build high hopes on the supposed discovery of the cause of his protean malady, often ending in bitter disappointment.

On the other hand, in many cases which at first sight appear to be pure neuroses, further careful search will reveal an adequate local cause for the condition of the patient, the removal of which will alone effect relief. Indeed, inasmuch as the nasal mucosa is a highly sensitive area which is in health the region for excitation of numerous physiological reflexes, it is inevitable that correlated reflex areas should sometimes be pathologically excited through the nose, in accordance with the law of irradiation of reflex action, viz., that reflex action extends from nervous areas in which it first operated to neighbouring efferent nerve areas by means of the communications between the different groups of ganglionic nerve cells.

Thus reflex nasal neuroses most frequently excite physiological reflexes and other symptoms in the upper respiratory tract—e.g., sneezing, coryza and vascular turgescence; next in frequency, morbid reflex phenomena in the lower tract—e.g., asthma, vasomotor bronchitis, while only very rarely are epilepsy, melancholia, cardiac symptoms, etc., dependent on nasal sources.

Hyperæsthesia is generally the immediate local factor in nasal cough, paroxysmal sneezing, hay fever, and hay asthma, but in all these conditions it is usual to find more or less definite abnormal conditions of the nasal mucous membrane associated with hyperæsthesia in the nasal passages.

Nasal cough is usually a hard persistent cough, generally ceasing during sleep, and unattended with expectoration or any complication.

Neuralgia in the various branches of the fifth nerve may be reflex, or may occur in *tic douloureux*.

Anæsthesia from implication of the fifth nerve may be due to hysteria, cerebral tumours, or intracranial syphilis. Incomplete anæsthesia is not unusual in old-standing large polypi and in various chronic degenerative diseases of the mucous membrane.

VASOMOTOR NEUROSES.

VASOMOTOR RHINITIS.

Simple erectile swelling and vascular engorgement occur in two forms: (a) Periodic vascular swelling; (b) Vascular engorgement with coryza and sneezing. Neurotic persons, especially females, gouty subjects, and excessive alcoholic drinkers, are prone to suffer from these phenomena. It is generally an indication of nervous prostration, imperfect digestion, or of sexual excesses. J. N. Mackenzie had a patient who invariably suffered from coryza after sexual indulgence. It is sometimes associated with slight abnormalities in the nasal passages. An instance of periodic rhinitis with turgescence of the turbinals and nasal catarrh recurring with each menstrual period occurred in my own practice.

The fullness of the nasal mucosa may be accompanied by general redness of the nose, or of the face, while, in rare instances, the redness and swelling of the nose which come on in heated rooms or after meals, are due to pressure of the distended middle turbinated bodies on the septum. Of this condition I have seen one or two instances, and the periodical redness and swelling of the nose, which rendered the patients almost unfit for society, were completely relieved by cauterizing the middle turbinated bodies. On the other hand, periodic redness of the nose is quite as often due to causes unconnected with the nasal passages, e.g., dyspepsia, and in such cases it would obviously be useless to interfere with the turbinated bodies.

Vasomotor rhinitis, with or without coryza and sneezing, is sometimes the earliest symptom of chronic ethmoiditis, and may recur for a long period before further signs and symptoms, such as mucopurulent discharge and nasal polypus, reveal the true nature of the affection.

Treatment consists in attention to the general health, cold bathing, regulated open-air exercise, the avoidance of enervating habits of

life, sexual or alcoholic excess, and so forth. Of internal remedies valerianate of zinc, arseniate of strychnine, belladonna, and various nervine tonics are the most likely to prove useful. When associated with chronic thickening or hypertrophy, the galvano-cautery may be used, one or two linear deep or submucous cauterizations being made over the turbinated bodies or septum.

Coryza Œdematosa is closely allied to rhinal hydrorrhœa. Mullhall records six cases to which he applies this term. It consists of a serous infiltration into the connective tissue of the inferior and middle turbinals, which is sometimes migratory and appears to be associated with irregularities of digestion in neurotic subjects. It is not an inflammatory affection, but is more allied to Quincke's œdema.

Rhinorrhœa.—Two distinct affections are characterized by the escape of clear watery fluid from the nose, viz. :—

(1) *Rhinal Hydrorrhœa*, a vasomotor neurosis, with transudation of watery fluid from the nasal mucous membrane, and

(2) *Cerebrospinal Rhinorrhœa*, in which there is an escape of cerebrospinal fluid from the roof of the nasal fossæ. It is in no sense a nasal neurosis, but nevertheless is most conveniently described here also.

RHINAL HYDRORRHŒA.

(CORYZA VASOMOTORIA PERIODICA.)

Idiopathic Rhinorrhœa, an affection of which the essential feature is profuse watery discharge from the nose, as distinguished from the escape of cerebral spinal fluid through the nose; while in some cases the discharge of fluid is preceded or accompanied by sneezing and lacrymation, and itching or pricking sensations in the nose; in others the "running" from the nose is the one and only symptom.

The *causes* of the affection are generally indefinite; the patients are usually neurotic, highly strung or overworked, and in some cases exposure to cold has seemed an exciting cause. Cerebral basal tumours, tabes, or serous meningitis may rarely excite sneezing and excessive secretion. The fluid is a true secretion rather than a mechanical exudation, due to excitation of the secretory filaments derived from the sphenomaxillary ganglion.

After the rhinorrhœa has persisted for some hours the mucous membrane becomes swollen and œdematous. As much as two or three quarts have been known to come away in the twenty-four hours. The discharge is a straw-coloured fluid consisting of water, with traces of sodium chloride and mucus, and does not reduce Fehling's solution.

Treatment of Vasomotor Neuroses.—The treatment mainly consists in attention to the neurotic condition of the patient, by massage, baths, change of air, tonics, etc. Dyspepsia, constipation, or any irregularities in the alimentary tract require attention. Engorgement or œdematous swelling of the turbinated bodies may be reduced *when necessary* by linear scarifications, or by one or two linear cauterizations with the galvano-cautery. Rhinal hydrorrhœa has yielded to treatment with small, repeated hypodermic injections of atropine and strychnine. Atropine may be injected into the nasal mucosa. The galvanic current also appears to have some curative influence, one pole being applied directly to the nasal mucous membrane.

CEREBROSPINAL RHINORRHŒA.

This affection, though not a neurosis, is considered here so as to contrast it with rhinal hydrorrhœa.

Spontaneous discharge of cerebrospinal fluid through the nose has been termed cerebrospinal rhinorrhœa by StClair Thomson, who was the first to fully describe the condition, and to whose work on the subject I am mainly indebted for the following description of the affection. In one case the escape of fluid was found post mortem to have taken place through a small hole in the dura mater by the side of the crista galli; in two others examined post mortem the point of exit could not be found, but it is probable that the escape usually takes place through the cribriform plate of the ethmoid. Generally there is a history of headache or other mental symptoms, which are relieved with the escape of cerebrospinal fluid.

The discharge of fluid is generally from one nostril, and it persists night and day without much intermission for weeks, months, or years. When the intermissions do occur, the cerebral symptoms, headache, etc., recur or are aggravated. There is no accompanying lacrymation or photophobia, but the long persistence of the flow may lead to the formation of nasal polypi.

Two typical cases of spontaneous discharge of cerebrospinal fluid from the nose may be cited viz. :—

Thomson's case was that of a female, aged 25, in whom the escape of fluid from the left nostril persisted day and night for over three years. She used from five to six handkerchiefs daily. There were four intermissions in the flow of sixteen days, twenty-eight days (two occasions), and two months duration respectively; at these times very severe headaches were present, chiefly over the left eye and back of the head, though at other times the health was excellent.

The author's patient seen in conjunction with Stocker (*Vide Brit. Med. Jour.*, Oct. 12th, 1901, p. 1042) was a female, aged 40. "Up to March last was apparently in good health, when she complained of aching in the limbs, and thought she had contracted a second attack of influenza. The running from the right nostril commenced at the same time, and has continued without intermission ever since, night and day. She went home to bed, and apparently had an ordinary attack of influenza, with feverish symptoms and slight headache, etc., but with the rhinorrhœa superadded. She was kept in bed for some time on account of another complaint (gastritis). About six weeks ago, when she began to get up, constant central frontal headache has been more noticeable; before that she had had occasional central frontal headache, but only since her illness began. The headache is never severe. She has had no attacks of sneezing, but has noticed slight itching of the eyelids. No cause for the disease is discoverable. She bumped her forehead violently in May, 1900, and fainted and had a headache for a short time, but it quite passed off by the following day. She has not had headaches since till recently. It will be noticed that the fluid drips from the right nasal passage only; it flows down the throat when she lies on her back at night."

Diagnosis.—The differential diagnosis between cerebrospinal rhinorrhœa and nasal hydrorrhœa depends mainly on the chemical composition of the escaping fluid, though the character of the symptoms also gives some indication of the nature of the diseases in question. Professor Halliburton's analyses (cited by Thomson) may be contrasted as follows:—

CEREBROSPINAL FLUID.

Fluid is perfectly transparent like water, and contains no sediment. It is not viscous. It is faintly alkaline in reaction, and either tasteless or slightly salt.

It gives no precipitate (mucin) on adding acetic acid.

The sp. gr. is 1005 to 1010.

Cold nitric acid gives a precipitate which disappears on heating.

Saturation with magnesium sulphate or sodium chloride gives a precipitate.

On boiling, there is not more than a trace of coagulum of serum

NASAL HYDRORRHOEA FLUID.

Fluid is thick and viscid, and slightly opalescent.

Histological examination shows the presence of amorphous matter and mucous corpuscles.

It gives, with acetic acid, a stringy precipitate (mucin).

On boiling this precipitate with dilute sulphuric acid, a reducing sugar-like material is formed. This is also characteristic of mucin.

The fluid contains a small amount of proteid coagulable by heat; *it*

NOTE.—It is essential that cerebrospinal fluid should be tested with Fehling's solution while quite fresh; it loses its reducing properties when allowed to stand for a day or so.

CEREBROSPINAL FLUID.

globulin and serum albumin. *When boiled with Fehling's solution there is a reduction of copper* (due to pyrocatechin or some similar body).

The reducing substance may be obtained in needle-like crystals by evaporating to dryness an alcoholic extract of the fluid.

NASAL HYDRORRHŒA FLUID.

does not reduce Fehling's solution. Proteoses and peptone are absent.

The presence of mucin and absence of reducing substance, as well as the considerable percentage of proteids and solids, are quite sufficient to distinguish this fluid from normal cerebrospinal fluid.

The symptoms also may be contrasted :—

CEREBROSPINAL FLUID FLOW.

Headaches precede or follow the flow, but cease or are diminished during the persistence of flow.

No nasal symptoms.

It persists night and day.

The fluid drying, leaves the handkerchief pliable.

No treatment is admissible.

NASAL HYDRORRHŒA.

Feeling of malaise sets in with the discharge, and disappears with its cessation.

Often ushered in with sneezing, lachrymation, etc.

It rarely continues during sleep.

The fluid drying, leaves the handkerchief stiff.

Disease is amenable to treatment.

Treatment.—The author's case of cerebrospinal rhinorrhœa became normal after persisting for a few years, and the "cure" followed some time after repeated lumbar puncture and withdrawal of fluid. How far the lumbar punctures contributed towards the happy end it is impossible to say, but this is the only case that became cured to the author's knowledge.

REFLEX NEUROSES.

PAROXYSMAL SNEEZING AND HAY-FEVER.

Etiology and Pathology.—Paroxysmal sneezing may be due (a) to reflex peripheral irritation, as in the earlier and milder forms of true hay-fever, in which the symptoms appear only when the patient is exposed to pollen, etc., and in cases due to some local abnormality in the nose; or (b) to a central neurosis, e.g., tabes.

Paroxysmal sneezing has often been noted in connection with sexual excitement.

Exciting Causes.—Paroxysmal sneezing may be excited by any irritation of the fifth nerve, either directly, e.g., from irritating dust

in the nose, impinging on a sensitive area, or from the irritation due to a septal spur, or reflexly by the action of bright sunlight (sensori-motor), or by sexual causes, or by the imagination (ideo-motor), as for instance the occurrence of sneezing and a regular attack of hay-fever induced in a susceptible person by the sight of an artificial rose in the room.

Hay-fever is simply paroxysmal sneezing set up by particular forms of irritating dust, to wit, pollen grains. Attention was first seriously directed to hay-fever by Bostock in 1819, who endeavoured to prove that the symptoms were due to the solar rays; but the researches of Blackley have proved that it is due to the action on the mucous membrane of the pollen grains of certain natural orders of plants, especially the pollen of graminaceæ, *anthoxanthum odoratum*, meadow grass, barley, wheat, and oats. Roses, and in America, Roman wormwood, ragweed, etc., have also a peculiar tendency to excite this affection. Any form of dust impinging on the nasal mucosa in susceptible individuals may bring on the symptoms.

Predisposing Causes.—As the exciting causes of hay-fever are practically universal, and every one must be exposed to them, while comparatively few suffer, it is obvious that individual predisposition is necessary for the symptoms to appear. And this applies to all cases of paroxysmal sneezing, which generally occurs in dwellers in cities, in the educated classes, and especially in those persons of the neurotic temperament; therefore to some extent it is hereditary.

Local Conditions.—The exciting causes are universal, the predisposing are very common, while the affection itself is *relatively* rare. Thus, a third factor is generally necessary, and this is found in the abnormalities and morbid conditions of the nasal passages. We are largely indebted to Roe, of New York, and Daly, of Pittsburg, for the recognition of these local conditions as causes of hay-fever, viz. : (1) Hypertrophic rhinitis; (2) Spurs and bony projections of the



Fig. 93.—Two grasses commonly causing hay-fever.

turbinals or septum ; (3) Septal deviations ; (4) Polypi and adenoid hypertrophy of the nasopharynx ; (5) Peculiarly sensitive areas.

Thus, for the occurrence of paroxysmal sneezing, three factors are generally necessary :—

- (1) The predisposing constitutional condition ;
- (2) An external irritant ;
- (3) A pathological condition of the nasal mucous membrane.

Symptoms.—Some neurotic women are subject to attacks of sneezing, occurring in paroxysms of thirty or forty sneezes, especially on rising in the morning, generally attended with rhinorrhœa, lacrymation, and temporary nasal obstruction, and sometimes with pain over the bridge of the nose. I have recently had a male patient who sneezed two hundred times a day, and was completely prostrated by the affection ; it was associated with a septal spur pressing on one of the inferior turbinals.

The symptoms of hay-fever come on in Great Britain about the middle of June, and in America about the middle of August, while simple paroxysmal sneezing may occur at any period. At first only a slight itching of the inner canthus is observed, and watering of the eyes. In a day or two some irritation in the nose, with watery discharge, comes on, with nasal obstruction, due, in fact, to vasomotor rhinitis, and pricking and dryness in the throat. Very soon attacks of sneezing supervene, and recur with increasing frequency without the pleasant sense of relief that is usually associated with a good sneeze. The conjunctivæ become injected, the eyes bloodshot, and the nasal passages more or less blocked up by the swelling of the mucous membrane and turgid erectile tissues. The fauces become relaxed, and even ordinary conversation becomes an effort.

At first the symptoms are merely annoying, but in pronounced cases with each annual recurrence they become more and more severe, and life is rendered a perfect misery during the three brightest months of the year. The symptoms are associated with intense prostration, altogether out of proportion to the local irritation, and health is greatly impaired for many weeks after the peculiar symptoms have subsided. A good many victims to hay-fever outgrow their susceptibility in later life.

Treatment.—As in all neuroses, we should bear in mind the importance of treating the general constitutional condition by promoting the health and strength. For this purpose a general hygienic and tonic treatment should be adopted, and in hay-fever a tonic

course is desirable for a few months before the usual time for the symptoms to come on.

Idiopathic paroxysmal sneezing dependent on functional affections of the nerve centre should be combated by nervine tonics, such as arsenic, strychnine, valerianate of zinc, and quinine.

If sneezing is due to abnormal conditions of the nasal passages, appropriate measures should be undertaken with a view to their removal. When erectile swelling and vascular injection of the mucous membrane are the only abnormality, I have found that spraying the nasal passages with a solution of biniodide of mercury (strength 1-10 to 1-20) has proved highly successful in curing many cases, myself among the number. A cocaine spray should be used beforehand, but as the cocaine is destroyed by the mercurial salt, it is necessary to relieve the pain which soon comes on by a hypodermic injection of morphine. The mucous membrane of the nose becomes much congested and swollen. In about three hours the pain and swelling subside, and are followed by a nasal catarrh lasting two or three days. In suitable cases if this be efficiently done at the onset of the symptoms of hay-fever, the patient will remain free throughout the season, and there are very few people who have suffered from hay-fever who will not readily undergo this or any treatment which promises relief. This method has the advantage of leaving the sense of smell unimpaired, and involves no destruction of tissue. Sir Andrew Clark advised a somewhat similar procedure for hay-fever, which gave relief in about 50 per cent of his cases, viz., painting the nasal mucous membrane with a mixture of carbolic acid, quinine, and perchloride of mercury.

Hypertrophic rhinitis and sensitive spots should be cauterized with the galvano-cautery, while septal deviations, polypi, spurs, and other abnormalities should be removed.

I have used with some success in mild cases of hay-fever insufflations of a powder composed of adrenal capsule 1 part, boracic acid 2 parts, and orthoform 3 parts. Cocaine should never be locally applied for the relief of hay-fever; it only tends to aggravate the condition after its transient good effects have passed off. Inhalations of the vapor benzoini, or v. benzoini c. chloroformo, are very soothing, as also are creosote, camphor, pinol, terebene, etc. These latter, dissolved in liquid vaseline, may be sprayed into the nostrils.

Pollantin is a serum-antitoxin, introduced by Dunbar, and is prepared from the blood of animals which have received injections of

the toxic substances from the pollen of certain grasses. It has yielded favourable results when used fresh, but it must be applied frequently to the nasal and conjunctival mucosa so long as the hay-fever symptoms persist. However, if it does not succeed at once in relieving symptoms, it is useless to persist in its use in any particular case.

ASTHMA.

It has long been recognised that asthma may be associated with intranasal disease, but it is only since Voltolini's classical case of asthma, which he cured by the removal of nasal polypi, that serious attention has been directed to nasal abnormalities as a cause of asthma.

The anatomical connections between the bulbar nuclei of the fifth nerve and the vagus, by means of which the upper and lower respiratory tracts are physiologically associated, have already been described and figured (pp. 34, 35), and we can therefore readily comprehend why in many cases there seems such close interdependence in their morbid relationship.

Asthmatic attacks are generally preceded or accompanied by sneezing and rhinorrhœa, or may alternate with, replace, or be replaced by, paroxysmal sneezing; in fact, these nasal phenomena must be regarded as part of the asthmatic syndromé, by no means indicating that the bronchial symptoms are dependent on the nasal. Just as bronchitis, emphysema, and other pathological conditions are a usual consequence of frequently-recurring attacks in chronic asthmatics, so we not unnaturally observe as a consequence of the nasal phenomena of asthma, hypertrophic rhinitis, water-logged mucous membrane, and perhaps even mucous polypi, these nasal affections being often the consequence, not the original cause, of asthma, however much they may tend to aggravate it.

The relationship of spasmodic asthma to nasal suppuration is too large a question to deal with at all fully, but I have had such conclusive evidence in cases under my own observation that true spasmodic asthma may be due to suppurative nasal disease, as to leave me in no doubt of their occasional interdependence. The very large percentage of patients with large nasal polypi who do not suffer from asthma, and the very large percentage of true asthmatics in whom no nasal polypi can be found, tend to prove fairly conclusively that there is no direct connection between nasal polypus and asthma as cause and effect. The nasal abnormalities which are frequently associated with asthma are causes of intranasal excitation, and similar conditions

result from infective inflammations in the accessory cavities, which, while eventuating in many cases in the formation of polypi, are also efficient peripheral causes of asthma in those with unstable nerve centres; afferent impulses from these act by influencing the bulbar respiratory centres, and through them the efferent nerves to the bronchioles.

Bronchial asthma arises from exaggeration of the contraction phase of the bronchiolar contraction and dilatation in expiration and inspiration which is normal, just as the *alæ nasi* and the glottic opening dilate with deep inspiration to contract with expiration.

However, when these or other intranasal affections cause more or less interference with nasal respiration, the bronchi are more exposed to the influence of irritating particles or exhalations by buccal respiration, and in these, restoration of the nasal respiratory functions by appropriate treatment will often tend to keep off the asthmatic attacks.

What are the nasal affections which may require treatment in asthma? The most hopeful cases for intranasal treatment are those in which mucous polypi are found, and it is more usual for small polypi to occur in asthma than for large polypi. On the tuberculum septi a spot of hypertrophied or thickened soft mucous membrane or a septal spur will sometimes be found impinging on the corresponding turbinal. In others, we shall find that there are particularly sensitive areas on the nasal mucosa, which, when probed, give rise to violent cough; I do not allude to the simple cough reflex obtained on probing many normal noses, and which may also be excited in many persons by a cotton-wool probe or plug in the external auditory meatus. The treatment of such conditions by cauterization will often prove helpful, but it is uncertain in result, and in no sense is there any justification for the recently advocated uniform cauterization of definite spots in the nasal passages as a specific cure for all cases of asthma. It is curious that with so many vaunted cures for asthma (I am not referring to the innumerable "quack" remedies), so many, even of those who have undergone the "cures," still suffer.

Often we shall discover nothing beyond hypertrophic rhinitis, œdematous mucous membrane, or vascular engorgement of the turbinal bodies. By the appropriate treatment of these and other intranasal conditions, I have obtained successful results; many cases have been immensely relieved, and some cured. Speaking generally, I have found that cases of inherited asthma are much less frequently due to nasal causes than the acquired forms, and it cannot

be too strongly emphasized that the existence of any of these nasal abnormalities in an asthmatic patient does not necessarily imply that they are causal factors. Yet if on the application of cocaine solution to the nasal mucous membrane the asthmatic attack is aborted or obviously relieved, we are justified in saying to the patient, "It is highly probable that local treatment of the intranasal abnormalities will result in considerable relief and possibly a cure, but whether the relief will be of long-standing or the cure permanent cannot be foretold; it is not even possible to promise that this local treatment will exercise any beneficial effect on the cause of the asthma."

The **Treatment** of the various nasal conditions alluded to has already been described elsewhere, but the general treatment of the patient should in all cases receive careful attention. It is curious that it is in cases in which a number of small nasal polypi are found, rather than those where the nose is almost blocked by a large polypus, that asthma occurs. The usual explanation is that large polypi, though causing more complete stenosis, are less mobile, and therefore probably less likely to irritate the neighbouring mucosa. The real explanation probably is that the small polypi are the result of ethmoidal cell suppuration, and that the latter condition is the cause of local irritation and asthma, the polypi in themselves having little to do with the matter. In some of my patients with well-marked and persistent asthma, the affection permanently subsided after removal of ethmoidal and sinus suppuration.

In the general treatment of asthma, the importance of tonic measures—exercise, massage, fresh air, cold and needle baths, sea-bathing—are often of very great value. For the attacks, iodide of caffeine or sodium, hyoscine, calcium lactate, extracts of *grindelia*, or *Myrtus chekan*, or ethereal tincture of *lobelia* may be given.

EPILEPSY.

Occasionally epilepsy has seemed to be caused by nasal abnormalities, the removal of which has been followed by cessation of the epileptic seizures, and I have had fairly definite proof that epilepsy may be induced by intranasal irritation in a patient who had an ordinary epileptic fit while I was cauterizing the nose for polypi. He never had a fit before, and had no further attack, at any rate during the next eight years.

Other similar cases have been recorded by different observers.

SECTION XI.

INFLAMMATORY DISEASES OF THE ACCESSORY SINUSES.
GENERAL INTRODUCTION AND ACUTE SINUSITIS.

ETIOLOGY

LEGAL RESPONSIBILITY

GENERAL SYMPTOMS

OBJECTIVE SIGNS

ACUTE SINUS SUPPURATION

GENERAL INTRODUCTION.

DISEASES of the nasal accessory sinuses are of great clinical importance, for they constitute a large proportion of the nasal affections which come under the notice of medical practitioners. They are sometimes easy, but often very difficult, to diagnose and treat, may cause great inconvenience to the patient, undermine the health, or lead to fatal complications. One assumes a knowledge of their anatomy (see p. 18 *et seq.*), without which it is difficult, if not impossible, to appreciate the symptoms and signs of inflammatory disease in these sinuses.

Inflammation of the sinuses may be acute or chronic, and the secretions catarrhal or purulent.

A sinusitis may be (1) **Latent**, (2) **Manifest**, (3) **Open**, or (4) **Alternating**.

If the ostium of the sinus remains more or less open, it is termed *an open sinusitis*, but if the aperture is occluded we have what is called a closed or "manifest" sinusitis, or a "closed empyema." In other cases while the secretion is able to escape it is unattended with local symptoms; to these the term "latent" is applied.

The division of empyemas of the nasal sinuses into "open" and "closed" is convenient for clinical purposes, and yet often enough a case cannot be placed in either group. For instance, an empyema may alternate between the two conditions, the ostium being more or less closed, with aggravation of the symptoms, till the accumulating secretion forces an exit, with accompanying relief of many of the

symptoms, and from being a closed empyema it becomes an open empyema. Thus the division of empyemas into *closed*, *alternating*, and *open* is more satisfactory for clinical purposes.

Etiology.—The accessory sinuses being lined by mucous membrane in continuity with that of the nose are liable to participate in all acute inflammatory affections of the nasal passages by direct extension, and to be secondarily infected by various chronic diseases, or by the secretion escaping from one sinus finding its way into neighbouring accessory sinuses.

Predisposing Causes.—Probably very few individuals in a civilized community pass through life without more than one attack of acute sinus inflammation in the course of acute nasal catarrh, influenza, etc., yet relatively few suffer from symptoms of definite acute or chronic sinus suppuration, because the secretions usually escape and the mucosa recovers spontaneously. But apart from peculiarly virulent infection which may determine sinus suppuration in some instances, the most frequent determining cause is a more or less obstruction in the neighbourhood of the opening of the sinuses, e.g., by a deflected septum or a large middle turbinal. There is often sufficient space for all purposes so long as the nose is in a state of health, although the swelling of an inflamed mucosa may suffice to cause complete obstruction in the narrowed territory, and consequently prolonged retention of secretions sufficient to result in pathological changes in the mucosa from which spontaneous recovery is no longer possible. In this direction localized obstruction and narrowing in the nasal passage become a source of danger when they may not interfere in any marked degree with normal respiration.

Direct or Exciting Causes.—To avoid repetition, the various direct causes of inflammatory processes in the different sinuses may be grouped together thus :—

1. Simple acute rhinitis may involve the mucosa lining any of the accessory sinuses, and chronic catarrhal or purulent sinusitis may result. The accessory cavities do not invariably participate in inflammatory diseases of the nasal passages, as some are inclined to think. In the course of his anatomical researches on the nose, Harke not infrequently found the mucous membrane of the nasal passages very severely inflamed, while that of the accessory cavities was entirely normal.

2. Acute infectious diseases, especially influenza and septic infections (erysipelas, etc.), less frequently measles, scarlatina, typhoid

fever, small-pox, pneumonia (v. Besser), diphtheria, glanders, gonorrhœa, and acute rheumatism.

3. Chronic infectious diseases, tuberculosis and syphilis, or the presence of a malignant growth.

4. The invasion of a sinus by insects, larvæ, etc., has several times caused a frontal sinusitis. Dochmeins found *Ankylostomum duodenale* in one patient's frontal sinus. Harke has found particles of tobacco in the antra of snuff-takers.

5. Occlusion of the ostium of one or more accessory cavities. Cases of empyema of the maxillary sinus following plugging of the nasal fossæ for epistaxis are recorded, and this illustrates how mechanical obstructions at or near the opening of a sinus may lead to sinus suppuration, e.g., mucous polypi. We must bear in mind that polypi and polypoid condition of the mucous membrane around the apertures are usually the result rather than the cause of empyema.

The Moral and Legal Responsibility of patients suffering from sinus disease is worthy of fuller consideration than has hitherto been accorded to this aspect of their complaint. E.g., a lady under my care who had frontal sinus suppuration was found to have stolen a valuable ring from a friend's house. Fortunately she was saved from painful exposure, and though she was unaware that the matter had been in the hands of the police, after recovery from a successful operation she told me of what she had done. I have no manner of doubt it was pure loss of memory which led her so nearly into trouble.

All patients who are the subjects of purulent sinusitis are liable to suffer from toxæmic symptoms, toxic products reaching the blood either from direct absorption from the implicated sinuses or from the gastro-intestinal tract, and impairment of memory, mental depression, irritability, etc., are very often marked symptoms. A number of cases of mental derangement have been caused by accessory sinus suppuration, and instances of mental recovery as the direct result of the cure of sinus disease are recorded.

General Symptoms.—Before describing in detail the symptoms of suppuration in the several sinuses, it is convenient to review some of the more important general features of these affections, as regards (1) Subjective symptoms, immediate and remote; (2) Objective signs; (3) Complications, although these points are all discussed in greater detail in connection with each particular sinus.

The symptoms of sinus disease are very variable in character and degree. The general health usually suffers appreciably, though in

long-standing cases patients may have become so accustomed to their mental or physical deterioration and consequent inability to work so long or so well as formerly, that they quite fail to recognize their real condition of poor health.

While **Localized Tenderness** corresponds to the cavity implicated, the headache and neuralgic pain are often referred to other areas in the territory of the fifth nerve; thus in antral suppuration we shall find the pain or headache is frequently confined either to the supra-orbital region or to the occiput.

Localized headache, pain, neuralgia, tenderness may be absent, slight, or severe, but one of the commonest complaints is pain or headache which alternates with a nasal discharge. Usually this alternation is attributed simply to stenosis of the aperture of exit of the implicated cavity, the secreting pus collecting and causing pain and headache from the increasing pressure, which sooner or later forces an exit through the ostium, with consequent escape of pus in the form of nasal or post-nasal discharge, according to the particular cavity involved, and consequent relief of pain and headache. This undoubtedly is the explanation of the very intense pain, such as is common in acute sinus suppuration and in some chronic cases, but in the latter especially there are three reasons why I believe such an explanation is often insufficient: (1) the aperture tends to become more patent as suppuration continues, (2) the exacerbations often arise while the purulent secretions are continuously escaping, and (3) in females, the exacerbations often definitely correspond to the menstrual period. I believe that the periodic pain and headache are often largely and sometimes even entirely due to inflammation, and that the relief which corresponds in time to increased secretion is really due to the subsidence of the inflammation, exactly as an acute bronchitis is relieved when secretion is promoted. It is a fallacy to assume that the ostia are always narrowed as a result of chronic suppuration, for it is by no means rare to find that a large frontal sinus bougie will readily enter a frontal sinus, and that a sphenoidal sinus ostium is very patent in long-standing suppuration. This point is well exemplified in *Plate XXXV*, from Zückerkandl's collection, and it is a question of considerable clinical import, for it explains why the mere establishment of free drainage does not always ensure the eventual cure of a chronic suppurating sinus, and in some cases even fails to prevent exacerbations with pain and headache. Under these circumstances we shall find that the

removal of the infected suppurating pyogenic tissues becomes essential for cure.

Fætor.—The patient often complains of a foul smell, although there may be no objective odour in the secretion. This subjective foul odour is termed “*cacosmia*.” It is most frequently associated with antral suppuration, and *cacosmia* may be the only complaint.

Defective Vision, especially in reading, sewing, and other fine work, contracted visual fields, some injection of the conjunctiva, and increased lacrymation or epiphora are symptoms common to frontal sinus, antral, and sphenoidal sinus suppuration; while amaurosis, intra-ocular suppuration, and other eye manifestations are liable to arise in sphenoidal and posterior ethmoidal disease. Eustachian catarrh and otitis purulenta, and more rarely meningitis and subdural or other intracranial abscesses, are possible complications. Anæmia and dyspepsia are very often caused by sinus disease.

Pharyngitis, Laryngitis, tracheal and bronchial catarrhal inflammations may be due to the infection by pus escaping by the posterior nares. It is usual for the patient to complain of discharge from the nose, but it is curious that purulent discharge from the nose may exist without attracting the notice of the patient, particularly if the discharge is post-nasal. Even the most intelligent patients may deny that they have any nasal discharge, when it may be obvious on examination, and when further exploration shows that an antrum or frontal sinus is secreting foul pus. This is of course unusual, but these cases occur, and if other symptoms are enough to arouse suspicion it is well to bear in mind the possibility of discharge which the patient has not noticed, perhaps because he has got so accustomed to its presence.

Recurrent Facial Erysipelas is sometimes due to ethmoid cell suppuration, and in other cases less definite attacks of recurrent œdematous inflammation arise, and the tissues of the upper lip and nose may become chronically infiltrated and thickened. The nasal symptoms may be slight or obvious enough on examination, but in a few cases I have observed the nasal secretion to be muco-purulent.

In one case a young girl completely recovered after operations on the ethmoid region and the maxillary antra (*Fig. 94*); and in another (*Fig. 95*), a boy, treatment by anti-streptococcal serum injections was suggested but refused.

Another patient suffered for many years from his nose, which persisted in getting red and swollen, and despite all abstemious

habits and quiet life, it was a constant and perpetual source of annoyance and humiliation to him. The lower half of the nose was doughy, with uneven surface, with fine venules coursing over it. Recovery followed after treatment for very extensive accessory sinus suppuration.

Objective Signs.—The most common is the presence of pus in the nose or in the post-nasal space, but as the sinus may have emptied itself before the patient is examined, or the discharge may be too



Fig. 94.—Nasal hypertrophy due to nasal accessory sinus suppuration.



Fig. 95.—Recurrent inflammatory edema of lips due to purulent nasal disease.

scanty to be seen at the time of examination, it is never safe to exclude sinus suppuration simply because no pus can be seen at one or even more interviews.

In the course of the introductory general remarks on sinus inflammation, the differentiation between **open**, **alternating**, and **closed** empyemas has been noted, and although such a classification may be applied to acute cases, it is in the more chronic sinus suppurations that these different types are most pronounced.

Much of the difficulty surrounding the subject under discussion disappears if we consider these accessory sinuses simply as a single series of cavities surrounding the nasal passages into which they open. They are all liable to inflammation by extension from the nasal

passages and other causes, and in pathology, symptoms, and general principles of treatment they have much in common, the differences being chiefly due to their different anatomical position and relations.

From the accompanying diagram (Fig. 96) it will be seen :—

1. That the accessory sinuses may be divided into two groups :

(a) The *anterior group*, comprising those whose ostia open into the



Fig. 96.—Diagram to show the arrangement of the accessory sinuses and their apertures of communication with the nasal passages.

The dark oblique line indicates the attachment of the middle turbinate bone, dividing the various cavities into A, the anterior group, and P, the posterior group. The anterior group comprises F, the frontal sinus, AE, the anterior ethmoidal cells, and the maxillary sinus, OM being the ostium maxillare. The anterior ethmoidal cells are further divisible into (3) lower, AE', (2) middle, AE'', and (1) AE''', upper or fronto-ethmoidal cells: 1, the infundibulum. The posterior group comprises, PE, the posterior ethmoidal cells, and S, the sphenoidal sinus.

middle meatus, that is, below the oblique line of attachment of the middle spongy bone (indicated by a thick line), viz., the frontal sinus, fronto-ethmoidal and ethmoidal cells, and the maxillary antrum; (b) The *posterior group*, comprising the posterior ethmoidal cells and sphenoidal sinuses, which open above the middle turbinal in the superior meatus.

2. That pus discharging from any of the anterior group will appear

in the middle meatus beneath the middle turbinated body, and that it will tend to pass towards the anterior nasal orifice, especially on stooping; while, on the other hand, pus coming from any of the posterior group should appear above the middle turbinal, that is, in the olfactory fissure, and it not only appears far back, but running down is further directed towards the posterior nares by the middle turbinal, and therefore passes into the rhinopharynx. The pus from this posterior group can often be seen by posterior rhinoscopy, coming from above the posterior extremity of the middle turbinal.

3. That *suppuration arising in the frontal sinus or anterior ethmoidal cells must often spread from one to the other, and that the pus in its downward course from these cavities may find its way into the maxillary sinus*. On the other hand, owing to the presence of polypi, or from extension by infection of the mucosa of the infundibulum, pus escaping from the antrum may find its way to the frontal sinus and ethmoidal cells. Thus suppuration in the different cells in the anterior group often co-exists.

4. That, for similar reasons, *suppuration of the sphenoidal sinus and posterior ethmoidal cells tend to be associated*.

5. That pus from the frontal sinus and the anterior ethmoidal cells tends to discharge more freely in the upright position, and to be a continuous discharge; pus from the antrum of Highmore will tend to accumulate in the upright position and to flow out freely from the *ostium maxillare* on lowering the head; pus from the sphenoidal sinus will also tend to accumulate in the upright position and to flow more freely on stooping; while pus from the posterior ethmoidal cells is likely to escape continually, and particularly with the head back.

6. That in closed or "manifest" empyema, in which the pus cannot escape, (a) distention of the frontal sinus may cause bulging of the posterior wall into the cranial cavity, bulging of the anterior wall above the orbit, and bulging of the floor (see *Plate XXII*), causing displacement of the eyeball downwards and outwards; (b) distention of the anterior ethmoidal cells may cause bulging of the roof of the cells just outside the cribriform plate (see *Plate XXVIII*), or, as more commonly happens, bulging of cell walls into the orbit, causing outward and downward displacement of the eyeball; (c) distention of the maxillary sinus may cause bulging of the cheek, the inner wall of the nose, or of the hard palate (see *Plate XX*); (d) distention of the sphenoidal sinus may cause compression of the optic nerve, cavernous sinus, or ptosis and strabismus from compression of nerves in the sphenoidal

fissure (see *Plate XXI*). Such distention of the sphenoidal sinuses is exceedingly rare, if it ever occurs; the symptoms of involvement of the optic nerve, cavernous sinus, or nerves in the sphenoidal fissure are generally due to extension of the inflammatory infective process.

With these facts in mind, it is comparatively easy to understand the symptoms and signs of sinusitis and their relative value in arriving at a differential diagnosis. Nevertheless, it is sometimes a very difficult matter to say for certain what particular sinus is implicated.

7. Pus from one sinus may enter and infect another. Thus in a large percentage of cases antral empyema is the direct result of pus descending from the frontal sinus passing into the antrum; and some cases of obscure origin are probably due to simple catarrhal secretion in excess gaining entrance into the antrum and there undergoing decomposition.

8. Injuries. Naturally it is the frontal and ethmoidal cells and antrum of Highmore which most often become affected, being liable to injury from blows on the face and nose. Two cases of antral empyema following section of the infra-orbital nerve are reported by Langenbeck.

9. Mercurial ptyalism and lead poisoning may cause antral empyema.

Wagner records a case due to chronic lead poisoning in which the mucous membrane of the antrum showed a peculiar bluish-grey hypertrophy, scrapings of which gave a characteristic reaction with sulphide of sodium. Phosphorus workers are liable to inflammatory disease and necrosis in the antrum and ethmoid cells. I have met with a case of recurrent frontal sinusitis that appeared to be due to malaria and was favourably influenced by quinine.

10. Not a few cases of antral empyema are undoubtedly secondary to caries of the teeth, the sockets of which project into the floor of the antral cavity, but it is very difficult to determine exactly what proportion must be attributed to dental caries, for though there are

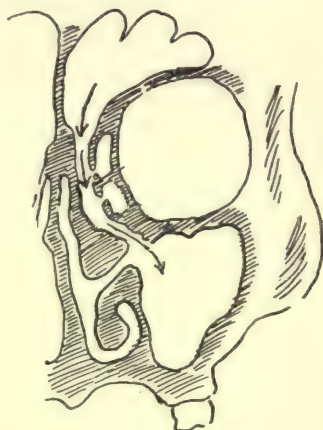


Fig. 97.—Diagram to show how pus escaping from the frontal sinus may be directed into the antral cavity, forming a secondary maxillary antral empyema.

relatively few cases without some carious teeth which from their position might have had causal influence, there is little reason to doubt that chronic antral empyema is itself often the cause of caries of the teeth corresponding to the affected cavity.

This list of diseases and conditions which have been known to cause sinusitis is a long one, but it will be found that the large majority of cases have succeeded attacks of influenza, and it is since the occurrence of the influenza epidemics commencing in the year 1889 that inflammatory diseases of the accessory sinuses have become common affections.

The bacteriology of nasal sinusitis has been the subject of investigations by Howard and Ingersoll, of Cleveland, and as a result of their own researches in eighteen cases and of very numerous collected observations, they reach the following conclusions: Acute and chronic inflammations of the accessory sinuses are with few exceptions (aspergillus and vermes) caused by bacteria. The bacteria found are those usually present in the nose in acute and chronic rhinitis, nasal tumours, etc. The most important and usual micro-organisms found in sinusitis are those common agents in the causation of inflammation in other parts of the air passages, viz., *Diplococcus lanceolatus*, pyogenic staphylococci and streptococci, bacilli of the group of Friedländer's bacillus, the *Bacillus diphtheriæ*, and the bacillus of influenza. They note as of special interest the finding by Fränkel of inflammation of these sinuses in individuals suffering with certain diseases such as nephritis, arteriosclerosis, and lung tuberculosis, which are now proverbially known so to lower the general resistance as to favour secondary infections.

Lewis and Logan Turner, as the result of an extensive research, showed that the pus obtained from some cases of antral suppuration may contain organisms similar to those occurring in the mouth; that 80 per cent of cases of chronic suppuration were associated with streptococci, but in more recent cases streptococci were found in 60 per cent only, virulent organisms being met with twice as often in recent cases as in the chronic, and that although occasionally bacilli distinctive of dental caries could be isolated from the antral pus, clinical evidence supported the view that the antrum is more frequently infected by way of the nasal cavity than by the teeth.

There are not sufficient data as yet to formulate conclusions as to the import of *cytological examination*. The absence of columnar ciliated epithelial cells suggests chronic degeneration, and in conjunction with the presence of lymphocytes seems to indicate that simple treatment such as lavage will be ineffective in curing, and that radical operative measures are called for.

In one of my cases of sphenoidal sinus empyema, the pus withdrawn with aseptic precautions yielded two micro-organisms in an agar culture, viz., a bacillus, with rounded ends, 2-5 μ long, about $\frac{1}{2}\mu$ thick, and a small diplococcus, thought to be the *Diplococcus intracellularis meningitidis* by D. S. Davies.

The secretion may be fairly clear mucous fluid, more generally it is greenish or yellowish, muco-purulent or purulent. It is often canary-yellow colour, due to the presence of *Staphylococcus pyogenes aureus*.

In catarrhal inflammations the mucous membrane at the outset is injected, and is often swollen and œdematous. The columnar ciliated epithelium seems to be shed very early, and soon is completely lost. In purulent inflammations the mucous membrane is infiltrated with cells and is swollen, and presents numerous submucous hæmorrhages, with papilliform hypertrophies in old cases, and not rarely a number of polypi will be found growing from it. Hyperostoses and osteophytic processes are described by Zückerkandl. But more important still than the formative osteitis is the rarefying osteitis with erosion of the wall in some long-standing cases, in consequence of which the wall may become softened or completely perforated, with escape of the purulent contents of the frontal, ethmoidal, maxillary, or sphenoidal sinus, as the case may be, into neighbouring tissues or cavities.

ACUTE SINUSITIS.

(Syn. SYRINGITIS.*)

Symptoms.—The supra-orbital aching and sense of fullness which is so common in ordinary acute nasal catarrh is due to implication of the frontal sinuses; a sense of fullness and indefinitely localized headache and pain and discomfort in the orbit and other symptoms referred to below may be due to sphenoidal sinus catarrh; dental neuralgia arises from acute catarrh of the ethmoidal and maxillary sinuses.

In the vast majority of cases of acute catarrhal inflammation, the symptoms are not pronounced, and subside spontaneously, the catarrhal secretion being discharged into the nasal passages. But sometimes in the acute catarrhal cases, and usually in the rare acute suppurative sinusitis, the swelling of the mucosa blocks the apertures of exit, so that the affected sinuses become painfully distended with the exudation.

The pain may be acute and lancinating, with an intolerable sense of distention, referred to the frontal region, root of the nose and orbit, or to the cheek, according to the particular sinus involved, and is often associated with localized redness, tenderness, and inflammatory

*Σύριγξ, a cavity.

swelling. The pain is usually greatly increased by blowing the nose, coughing, sneezing, lowering the head, or by any exertion.

Tenderness and increased pain on pressure in the upper internal angle of the orbit is usual in frontal or ethmoidal sinusitis; over the antrum, or at the exit of the superior maxillary nerve in maxillary sinusitis. Generally in the course of a few hours the distention of the accumulating secretion forces an exit through the natural opening, and with the sudden evacuation of the turbid, greenish, sero-purulent fluid the painful symptoms disappear.

The same course of events may recur several times for one or two days, or, on the other hand, no spontaneous evacuation may take place, in which case the walls of the cavity may yield, and a mucocele, or, if the secretions become purulent, an empyema, results.

Again, the walls of the sinus may be eroded where they are thin or represented only by soft tissues, and the contents escape; or, without perforation of the walls, pathogenic organisms may find their way out through vessels or lymph channels, and there set up suppurative inflammation. In these ways an acute suppuration of the frontal sinus or ethmoidal cells may cause meningitis, or an extradural abscess beneath the frontal lobe of the cerebrum, or suppurative cellulitis in the orbital fossa, or the eye may be displaced in various directions, e.g., downwards and outwards in frontal sinusitis, outwards in ethmoidal cell suppuration.

These complications are more liable to arise in the chronic purulent sinusitis, and will be discussed more fully in that connection; but it is necessary to bear in mind that in acute suppurative disease of these sinuses, likewise of the sphenoidal sinus, very grave symptoms pointing to cerebral irritation and compression may rapidly develop.

Acute Sphenoidal Sinusitis, although probably rare, requires further consideration, because the symptoms are often most misleading and the affection is very dangerous to life. The following case in point will exemplify the serious difficulties that may occur:—

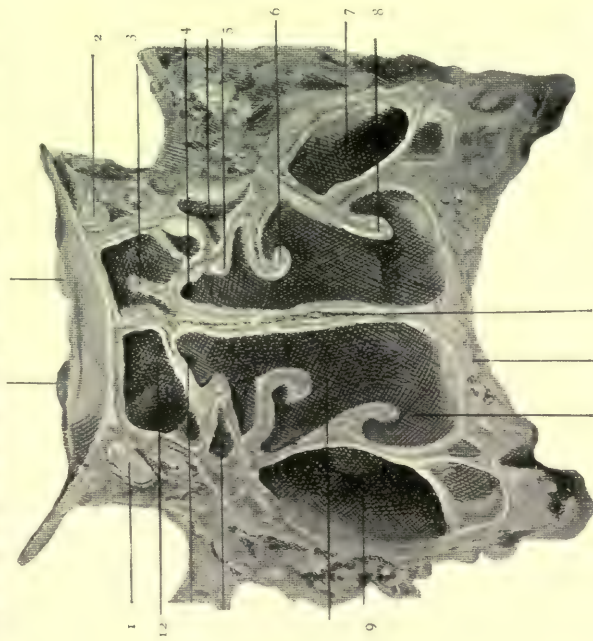
In consultation with Dr. H. Willcox I examined a lad, aged 12, for acute pain in the right ear, with slight febrile disturbance and photophobia. It had lasted a day or two, and the symptoms suggested acute middle ear disease. But the membrana was normal, and there was entire absence of any tenderness over the mastoid, or other indications of aural trouble. On examining the nose, there was some slight rhinitis, and the previous history seemed to point to a mild influenza attack. I came to the conclusion that he had recent sphenoidal sinusitis, and gave a very guarded prognosis, notwithstanding the absence of alarming

TRANSVERSE SECTIONS THROUGH THE NOSE.

IN EACH CASE THE POSTERIOR PORTION IS VIEWED FROM THE FRONT.

Fig. A.—Section behind the Second Molar Teeth.

On both sides the optic canal grooves the posterior ethmoid cells. The maxillary antrum on the left side is much smaller than the right; in the right is seen a partial transverse bony septum, which would prevent simple flushing of the antrum being successful in curing a chronic empyema.



- 1. Right optic nerve
- 2. Left optic nerve
- 3. Left posterior ethmoidal cell
- 4. Ostium sphenoidale
- 5. Superior turbinal
- 6. Middle turbinal
- 7. Left maxillary antrum
- 8. Left inferior turbinal
- 9. Right maxillary antrum

Fig. B.—Section behind the First Molar Teeth.

The right sphenoidal sinus is fairly normal, but the left is quite small, and almost central, being encroached on by the backward extension of a large posterior ethmoidal cell. The right optic canal traverses the upper and outer wall of the right sphenoidal sinus; but the left sphenoidal sinus is not in relation with the left optic canal, which passes across the upper and outer part of the left posterior ethmoidal cell.



- 1. Right optic nerve
- 2. Left optic nerve
- 3. Left posterior ethmoidal cell
- 4. Ostium sphenoidale
- 5. Superior turbinal
- 6. Middle turbinal
- 7. Left maxillary antrum
- 8. Left inferior turbinal
- 9. Right maxillary antrum
- 10. Left sphenoidal sinus
- 11. Right sphenoidal sinus
- 12. Right posterior ethmoidal cell

symptoms, for the boy had not felt ill enough to be in bed. We decided on a course of local inhalations, sedative sprays containing cocaine and suprenine, with the hope of causing the sinus to evacuate itself, his condition at that time not being sufficiently urgent to warrant opening the sphenoidal sinus, a procedure which is very difficult and dangerous in so young a child with undeveloped sphenoidal sinuses. Not improving, he was seen by Mr. Arthur Cheatle, who decided that, at any rate, there was nothing calling for aural operation. After a further interval, when the headache had become general, and the child was only semi-conscious, Sir Victor Horsley saw him, and then diagnosed "influenzal cerebrospinal meningitis." At the *post-mortem* examination an accumulation of pus was found around the right cavernous sinus. Apparently influenza infected the sphenoidal sinus, causing sphenoidal sinusitis and pain in the ear, and the infection spread through the lymphatic channels and the subarachnoid space surrounding the cavernous sinus, and hence spread throughout the subarachnoid space.

Usually in acute sphenoidal sinus suppuration the pain is referred to the back of the eye, and is associated with other symptoms of chronic sphenoidal sinus suppuration, but the acute infections are probably more dangerous and more liable to intracranial complications, such as cavernous sinus thrombosis.

Treatment.—The main indications are to relieve pain and to promote evacuation of the secretions through the natural apertures of exit. Hot fomentations externally and inhalations of steam impregnated with tincture of benzoin and chloroform are soothing, and should be combined with the internal administration of phenacetin, phenazone, aconite, or belladonna to relieve the pain, headache, and feverishness. A blister applied to the mastoid region will sometimes relieve the pain due to sphenoidal sinus inflammation. It is well to avoid alcohol, as it often aggravates the disease.

The swelling and obstruction of the natural channels to the sinus may be reduced by spraying the nasal passages, and especially the region of the ostium of the affected sinus, with an oily solution of cocaine and menthol, or an aqueous solution of suprarenal capsule and cocaine. Hartmann's suggestion that Politzer's bag should be used, although it often affords instant relief, does not commend itself to me, except perhaps in cases where one maxillary antrum or frontal sinus is alone involved, as there is always a risk in acute inflammatory affections of the upper respiratory tract of driving infective material into the Eustachian tubes. Sondermann's or Bier's suction apparatus are safe and sometimes helpful. If by these means evacuation of the retained secretion cannot be brought about, and

especially if there is reason to suspect that suppuration has occurred, the affected cavity must be opened by operative methods described



Fig. 98.—Sondermann's suction apparatus for inducing secretion to flow out of the accessory sinuses into the nasal passages.

in the section on chronic empyema, and efficient drainage secured. If the frontal sinus or maxillary antrum has to be opened, it is not necessary or desirable to perform a *radical* operation or to curette the mucous membrane; it should be treated like an acute mastoid antral suppuration,—that is to say, the cavity should be simply opened and drained, and the mucous membrane will then almost invariably recover. It is obvious that signs of extension of the inflammation to the orbit or to the cranial cavity are indications for immediate operation.

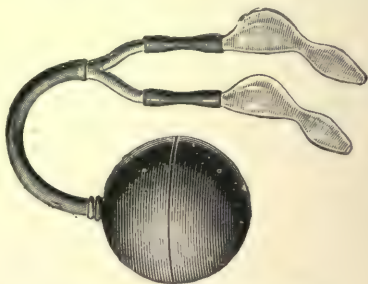


Fig. 99.—Bier's nasal aspirator.

SECTION XII.

*THE SYMPTOMS AND DIAGNOSIS OF
CHRONIC SUPPURATION OF THE ACCESSORY SINUSES.*

OF THE MAXILLARY ANTRUM
OF THE FRONTAL SINUSES
OF THE ETHMOIDAL CELLS
OF THE SPHENOIDAL SINUSES

SKIAGRAPY OF ACCESSORY
SINUSES
OCULAR COMPLICATIONS OF
NASAL AND ACCESSORY
SINUS DISEASE

CHRONIC EMPYEMA OF THE MAXILLARY ANTRUM.

CHRONIC EMPYEMA of the maxillary antrum, or antrum of Highmore, was described by John Hunter, but the credit of recognizing the frequent occurrence of the affection without the classical signs of pain, swelling, and tenderness, is due to Ziem, who published his first paper in 1886.

It may occur at any age, though it is rare in children. D'Arcy Power reports its occurrence in a boy eight weeks old, probably caused by forceps in delivery; and Rudaux another instance of empyema in an infant, only three weeks of age, in whom it was set up by a prematurely developed tooth in the antral cavity.

Symptoms.—In the open or latent form, by far the most common, patients generally complain of a constant or periodic discharge of considerable quantities of sticky pus from one side of the nose. Not infrequently attention is first attracted by blocking of the nose, either from the swelling of the mucosa or from the presence of polypi. The symptoms are generally unilateral, but antral empyema is very frequently bilateral. Pain and tenderness over the region of the antrum, or dental neuralgia, is occasionally noticed, and may be described as boring, nibbling, or bursting. Infra-orbital neuralgia and tenderness over the infra-orbital foramen are more common; on the other hand, the pain may be supra-orbital, with a sense of burning or boring over the corresponding frontal sinus, or it may be referred to the occiput.

Again, in other patients, severe headache, sometimes unilateral, is the most notable symptom, sometimes associated with mental depression, giddiness, insomnia or drowsiness, and dragging pain at the back of the eye; and indistinctness of vision for fine work such as sewing or reading, on the side corresponding to the affected antrum, is a frequent symptom. The unilateral discharge of pus is especially liable to occur on rising from bed, or on stooping, or lying with the head on the sound side.

The patient usually complains of a constant or intermittent fœtor, and this *cacosmia* may be the only symptom noticed when the purulent secretion is small in quantity. In others, loss or perversion of taste is the prominent symptom.

When, owing to occlusion of the ostium and absence of any apertures of exit, the pus is permanently retained, the antral cavity may become distended. A smooth, hard, tender swelling then appears on the cheek corresponding to the antrum, although such distention of the cheek is more commonly due to either cystic disease or myxomatous polypi. The thin and partly membranous internal wall more usually yields first, and next in frequency the floor of the orbit is pressed upwards, with resulting displacement of the eye upwards, or, very rarely, forwards (exophthalmos). It is quite exceptional for a fistula to occur, but if it does form, it is almost always in the nasal wall, the weakest point.

Though permanent occlusion of the *ostium* is exceedingly rare, temporary occlusion is not infrequent, the symptoms and physical signs becoming greatly aggravated, with some redness and swelling over the cheek, in the canine fossa, or on the outer wall of the nasal passage, till with increasing pressure the aperture is forced by the accumulated secretions, the recurrence of the nasal discharge being accompanied by relief of symptoms and subsidence of the localized swelling.

Various secondary symptoms may develop, and these may become so pronounced that their actual cause be overlooked, e.g., defective vision, lacrymation, pains in the orbit, disturbances of taste or smell, paroxysmal sneezing: or, again, headache, sometimes frontal, sometimes parietal, occasionally occipital, may be the chief or only complaint. The pus escaping into the pharynx may set up catarrh of the Eustachian tube and consequently deafness and tinnitus; or by trickling down to the larynx produce violent attacks of coughing and choking on lying down at night. The pharynx also may be so irritated and inflamed that swallowing is painful.

Nasal Accessory Sinus Disease.

FIG. 1.



FIG. 2.

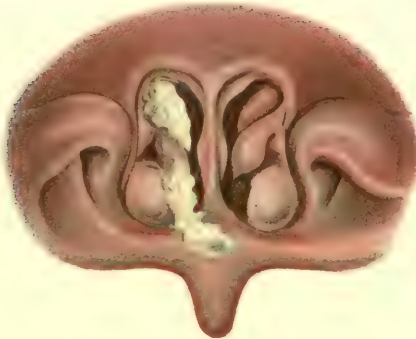


FIG. 3.

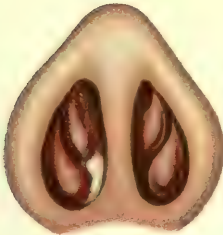


FIG. 4.



FIG. 5.

FIG. 1.—Case of right antral empyema. Pus is seen in the right middle meatus, the outer wall of which is swollen, giving the appearance of “cleft” or double middle turbinal on the right side.

FIGS. 2 and 3.—Suppuration in the frontal sinus and anterior and posterior ethmoidal cells on the right side. The pus appears above the middle turbinal, by both anterior and posterior rhinoscopy.

FIGS. 4 and 5.—Case of sphenoidal sinus suppuration. On anterior inspection some pus was seen far back near the floor of the nose. Posteriorly, the pus is seen after its escape from the sphenoidal sinus mainly on the right side.

Diagnosis.—The chief indications of antral empyema are :—

1. **Pus in the Middle Meatus.**—The most constant sign is the presence of a small bead of pus appearing some way back beneath the middle turbinal. Pus in this spot may come from any of the anterior group of sinuses, but if after wiping the pus away it re-appears in the spot *immediately*, the evidence of antral empyema is strong. If mucous polypi are present in the middle meatus, pus may or may not be seen on or around the polyps, but the fact that polypi are there increases the suspicion of antral disease.

2. **Cacosmia, or Subjective Fœtor.**—The pus is generally fœtid, in which case the odour is perceived by the patient, except when the antral disease is a complication of ozæna—a very rare association in my experience. This subjective fœtor, without obvious cause referred to one nostril only, is often a very important symptom, and is sometimes the only symptom of which the patient complains.

3. **Pathological Conditions in the Mucous Membrane.**—When no pus is to be seen in the nasal passage, we may still be led to suspect antral empyema from the secondary changes in the middle meatus. Most frequently oedematous polypi are found, or oedematous granulations round the margin of the *hiatus*, together with redness and swelling of the mucosa of the inferior meatus. But in place of swelling there may be a dry chronic catarrh of the nasal passage on the affected side.

The condition of the teeth will sometimes throw some light on the case. They may be all quite sound except those corresponding to the diseased antrum, and these may be carious or have “dropped out.”

There are three other tests by which the diagnosis may be rendered more certain :—

1. **Position Test.**—After tilting the patient's head laterally, so that the suspected antrum is uppermost, I have often found that the pus may be watched welling into the middle meatus during anterior rhinoscopy.

2. **Fränkel's Sign.**—Pus reappears on the patient inverting his



Fig. 100.—Anterior view of the nasal passages of a patient with empyema of the right antrum. The right middle turbinated body appears to be double, owing to the swelling of the external wall of the middle meatus, but the pus is really escaping between the middle turbinal and the swollen mucous membrane referred to.

head and tilting it so that the sound side is uppermost. Inversion of the head does not cause a flow of pus from the frontal sinus, but may cause it to flow from the anterior ethmoidal cells. The amount of pus coming from these small anterior ethmoidal cells is usually small, and it very seldom accumulates in sufficient quantity to flow out on inverting the head.

3. **Transillumination Test**, as suggested by Voltolini, and developed by Heryng.—A small four- to eight-candle-power electric lamp is placed in the mouth, which is closed, the room having been rendered absolutely dark. In a normal patient the nasal passages and the cheeks become illuminated by a rosy-red transmitted light, the patient

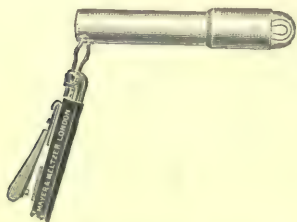


Fig. 101.—Vohsen's lamp for electric transillumination of the antrum.

often perceiving a sense of light himself. Any difference in the amount of light transmitted is estimated, and if pus be present in the antrum, or if it is the seat of a solid tumour, there is generally an obvious shadow on the affected side, more especially in the infra-orbital region, and the patient himself will often perceive light on the sound side only.

Sometimes the pupil of the eye on the side of the empyema remains dark, instead of being illuminated like its fellow on the sound side. This absence of the "pupil reflex," as it is called, is the most reliable sign in transillumination of a suppurating antrum. But a strong light in the median position in the mouth may be transmitted to the nasal passages, and thence reflected by the turbinates to the orbit, even when the antrum itself is opaque. I therefore never omit to confirm or correct any observations by placing the light first on one side and then on the other, so as to be immediately below the right and left antrum alternately. A pupil reflex with the lamp in this position absolutely excludes antral suppuration. If the lids be kept closed during illumination, the patient often perceives the light on the sound side only, or more strongly than on the side of the empyema.

CONDITIONS THAT MAY INFLUENCE TRANSILLUMINATION.

As transillumination is one of the most constantly employed tests, the following statements by Brown Kelly, based on an extensive investigation, are of great value:—

TRANSILLUMINATION THROUGH THE MOUTH.

In a Normal Subject and in a Case of Suppuration of the Right Maxillary Antrum. (Kelly.)

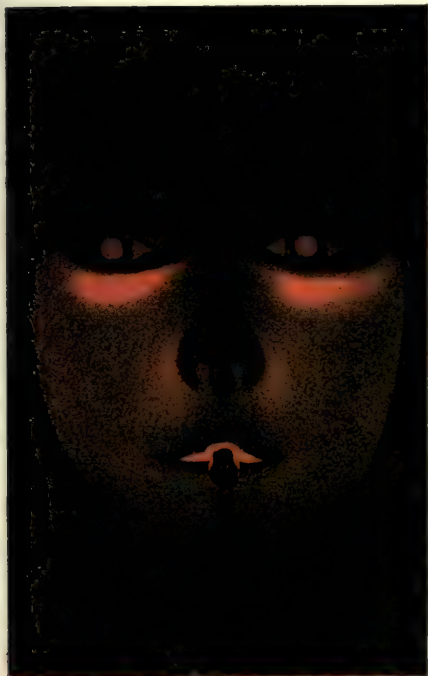


FIG. 1.

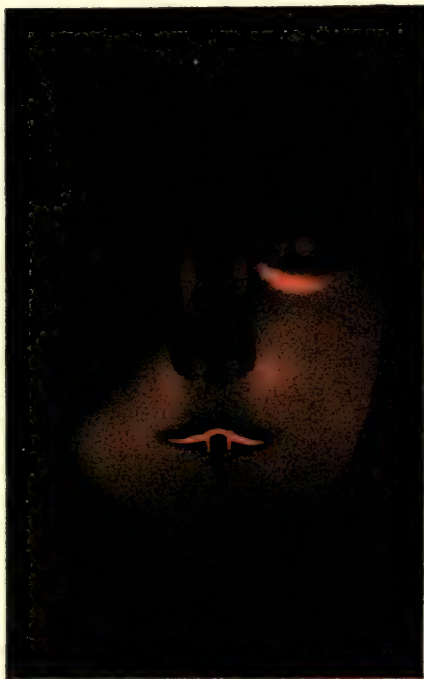


FIG. 2.

FIG. 1.—Usual appearance when both antra are normal. The crescentic tache and pupils are bright, the infraorbital tache are less so.

FIG. 2.—On the right side no transillumination of antrum, owing to purulent contents. On the left side transillumination is normal; the infraorbital tache is specially bright, and is not demarcated from the crescentic.

Extra-antral Conditions.—Experience has shown that the antrum is transilluminated best in spare, thin-boned, fair persons, whose palate is not more highly arched than normal, and whose nasal fossæ are free and roomy.

Conversely, those with a highly V-shaped palate, or with narrow, obstructed nasal passages, usually transilluminate badly.

Transillumination of the pupil may be prevented by purulent ulcer of the cornea, dullness of the lens or vitreous, or closure of the pupil (Ziem). Burger thinks that the difference in transillumination of the eye may be due in a large proportion of cases to the condition of the pigment layer of the choroid.

Intranasal Conditions.—These may be either of an anatomical or pathological nature. The anatomical peculiarities which may cause the signs to be partially or totally obscured are the small size of the cavity and the presence of bony partitions. Pathological conditions, either by giving rise to the accumulation of morbid products within the antrum, or by causing changes in the lining membrane, may affect transillumination favourably or unfavourably.

(a) Conditions increasing the brilliancy: (1) Cysts with clear contents causing thinning and distention of the antral walls.

(b) Conditions diminishing the brilliancy: (1) Collections of pus, mucous, blood, etc., which may be of intra- or extra-nasal origin; (2) Inflammatory thickening of the lining membrane; (3) Tumours which may originate within the cavity or invade it from without.

Fallacies.—In practising transillumination a fallacy may arise in one of three ways:—

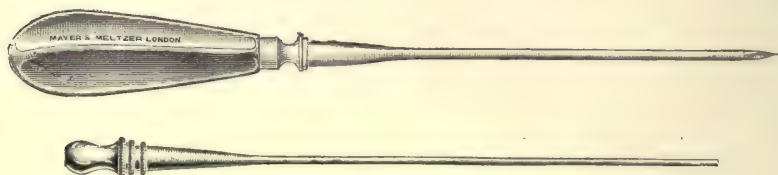
1. Transillumination may be equally brilliant on both sides, and yet one antrum may contain pus. In such a case the amount of pus in the cavity is usually very scanty, and the lining membrane is little or not at all changed. These conditions are sometimes found when the pus is of dental or extra-dental origin. This fallacy will more readily occur if too strong a light is used.

2. Transillumination may be bright on one side and darker or absent on the other, and yet on the non-illuminated side the antrum may contain no pus. The unilateral darkness may be due to the following conditions: (1) Abnormal thickness of the bony wall of the antrum and small size of the cavity (asymmetry); (2) Thickening of the antral lining membrane in consequence of previous disease; (3) Solid tumour in the antrum; (4) More or less obstruction of the corresponding nasal fossa. On the other hand, the antrum that transilluminates well may, as shown under 1, contain pus.

3. Both antra may transilluminate badly, or not at all, and yet they may contain no pus. The bilateral darkness is usually due to the light being too weak, or to conditions outside the antrum influencing transillumination unfavourably—for example, thick bones, high palate, and obstructed nasal cavities.

Puncture and Lavage.—This exploration test may be made by means of a Lichtwitz trocar and cannula, or with the author's

exploratory needle cannula, passed through the wall of the *inferior* meatus; or by drilling through the socket of a decayed tooth after its extraction. Puncture with a Lichtwitz or the author's needle is easily done under local anæsthesia. A pledget of wool, moistened with 10 to 20 per cent cocaine, alypin, or novocaine, is inserted between the anterior end of the inferior turbinal and the outer wall of the meatus for about five or ten minutes, and then withdrawn. With the



Figs. 102 and 103.—Lichtwitz' trocar and cannula.

help of a nasal speculum the exploring instrument is passed along the inferior meatus in a slightly upward and outward direction, so as to impinge on the upper thin portion of the meatal wall about one inch from the nasal orifice. The patient's head being steadied, the trocar is directed well outwards, and then gentle pressure causes the instrument to enter the antral cavity. If the trocar does not readily enter, it is only necessary to move the point of the trocar a little more upwards or backwards so as to impinge on a thinner part of the antro-



Fig. 104.—The author's antral needle cannula. The antrum having been entered through the middle or the inferior meatal wall, it is attached to the universal syringe for lavage.

meatal wall. The trocar is withdrawn, leaving the cannula in the cavity; a rubber tube attachment is placed in the proximal end, and the contents are aspirated or washed out with clean boracic solution. Any pus in the cavity thus appears in the receptacle, and diagnosis is confirmed or negatived. In making the entry to the antrum, the instrument should be so held that it cannot suddenly enter more than a quarter of an inch, otherwise the trocar may puncture

PLATE XIV.



Fig. A.—One of the author's cases of sphenoidal sinus suppuration, with cavernous sinus thrombosis and consequent exophthalmos.

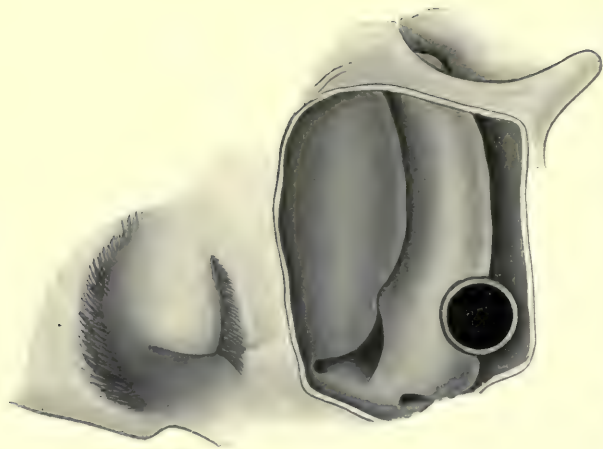


Fig. B.—The author's operation on the maxillary antrum, slightly reduced.

the outer wall and carry the trocar into the canine fossa ; or a deep entry, if made in too upward a direction, might perforate the antral roof, which is the floor of the orbit. If the trocar perforates through to the canine fossa the point can be felt with the finger tip under the lip.

The middle meatus is readily entered by an exploratory trocar or needle, as the outer wall of the nose is thinnest here, but though this route has been advocated, it is less satisfactory than the former, and it is, moreover, attended with the risk of the needle entering the orbital cavity. By whichever way the cavity is entered, pus may well out, or may be drawn out through the needle or trocar. But if it does not appear, the cavity should be washed out, or peroxide of hydrogen injected. If pus is present it is driven out and fills the nose as a white foam.

CHRONIC FRONTAL SINUSITIS.

Symptoms.—Empyemas of the frontal sinus may be divided into three groups : (a) Open ; (b) Intermittent or alternating ; and, (c) Closed.

A closed empyema, or, if it be a catarrhal inflammation without suppuration, i.e. a mucocele, occasionally produces external signs if there is yielding of the walls, and as the inner part of the floor corresponding to the inner angle of the orbit is the thinnest point of the walls, it is the usual seat of the external swelling. The eye is displaced downwards and outwards, and since this and the orbital swelling are the most notable features presented, these rare cases are often referred to ophthalmic surgeons.

On the other hand, the anterior wall or the posterior wall may yield, in the one case producing a facial deformity, and in the other symptoms of compression of the frontal lobe of the cerebrum.

Usually the earliest symptom is intermittent central frontal headache or supra-orbital neuralgia.

The headache is generally increased by exertion or by pressure, mental effort, or the use of alcohol, and very often resembles migraine, sometimes being attended with nausea and vomiting, or with an intermittent feeling of falling. With increasing secretion the headache may be severe and almost unendurable, till, with the escape of yellow pus or mucopurulent secretion, the symptoms are mitigated.

Even in "open" frontal empyema, which is much more common

than the "closed," frontal or supra-orbital headache is usually a marked symptom; sometimes the headache is occipital. In other cases again the headache is not severe, hardly amounting to more than a dull, heavy feeling over the frontal sinus, aggravated by stooping, and especially by pressure over the upper internal angle of the orbit. Loss of appetite, diurnal somnolence, and general mental dullness and apathy may be present. But often enough the symptoms are of a very indefinite character in the absence of complications. When the frontal nasal duct is not closed there is discharge of pus in the middle meatus, and after cleansing the passage and wiping away the pus with a pledget of wool it usually re-appears after a short interval, towards the anterior extremity of the middle turbinal. If the pus be small in amount, Grünwald suggests the plan of keeping a pledget of cotton-wool tightly packed in the middle meatus to temporarily dam up the secretion, so that it flows again more freely on removing the pledget. Pus here must come from one of the anterior group, but in frontal sinusitis it does not re-appear more

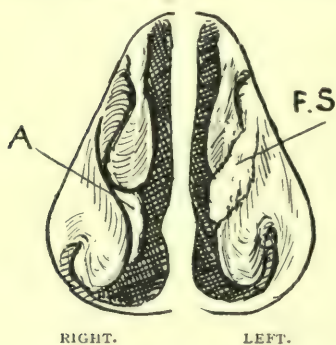


Fig. 105. — In the right nasal passage pus is escaping far back in the mid meatus from the antrum; in the left passage the pus comes from the frontal sinus, and is too far forward for antral pus unless the patient has stooped and covered the head.

freely, after being wiped away, by lowering the head, as in maxillary empyema. If by this and other signs maxillary sinusitis is excluded, we have then to consider only frontal sinus and anterior ethmoid cell disease, which very often co-exist. If, on probing the bulla ethmoidalis and the region above it, no softening or bare bone is detected, it is probable that the lower cells of the anterior ethmoid group are not the source of the pus. In frontal empyema the pus escapes more readily in the upright position, and so the patient finds it most abundant on rising in the morning, continuing more or less persistently throughout the day. It is not generally very

fœtid, but the patient often complains of the smell—cacosmia.

Without laying too much stress on the point, one may sometimes find a hint of value in differentiating between pus from the antrum and that from the frontal sinus, in that antral pus escapes further back in

the middle meatus than frontal sinus pus. It is rather in cases where antral empyema is complicated by hitherto unsuspected frontal sinus disease that the point is useful.

Complications.—There are those in the nasal accessory sinuses due to implication of the anterior ethmoidal cells and the corresponding maxillary antrum. The association of purulent sinusitis in several of the accessory nasal cavities has already been discussed, but it may here be remarked there are relatively few empyemas of the frontal sinuses alone, the majority of cases being complicated by implication of the ethmoidal cells with all their attendant dangers.

2. The continued flow of pus causes inflammatory changes in the nasal mucosa. Polypi are very often found crowding round the lower end of the infundibulum, and atrophic changes resembling ozæna may arise.

3. Apart from the displacement of the eye in closed frontal sinusitis, dacryocystitis, redness and tenderness in the inner angle of the orbit, and aching in the eyeball are met with in latent cases. Again, if congenital lacunæ are present in the inner part of the floor or from softening of the wall, perforation takes place towards the orbital cavity, suppurative cellulitis will arise, phlegmon of the orbit being most frequently due to this cause according to German.

4. Various cerebral complications may occur, either due to pressure from yielding of the posterior wall compressing the frontal lobe, or from perforation following erosion of the wall, with resulting suppurative meningitis or frontal abscess. But an abscess in the frontal lobe may be produced without any bone lesion, micro-organisms being carried directly by the lymph channels or blood-vessels, just as a temporo-sphenoidal abscess may arise in suppurative otitis. In a few cases the posterior wall of the sinus may be congenitally defective.

5. Another fortunately rare complication is the occurrence of septic osteomyelitis involving the diploic sinuses, tending to become diffused over the whole cranial vault. The skin and soft tissue over the invaded bone is puffy, and pits on pressure; in other words, it resembles Pott's puffy tumour, for there is no suppuration here. Instances of this fatal complication have been recorded by Luc and Tilley.

Diagnosis.—Closed frontal empyema is rare, but may result from suppuration of a mucocele. It generally presents such definite external features as to leave no difficulty in the diagnosis, but the external deformity may be simulated by simple mucocele, various tumours, or by a dermoid cyst.

It is, however, often very difficult to diagnose a latent frontal empyema with certainty, and one has generally to rely largely on the exclusion of other sources for the pus appearing. When the symptoms point to frontal sinus, and firm pressure on the floor of the sinus by the tip of the finger or thumb at the upper internal angle of the orbit is painful, the following tests should be employed :—

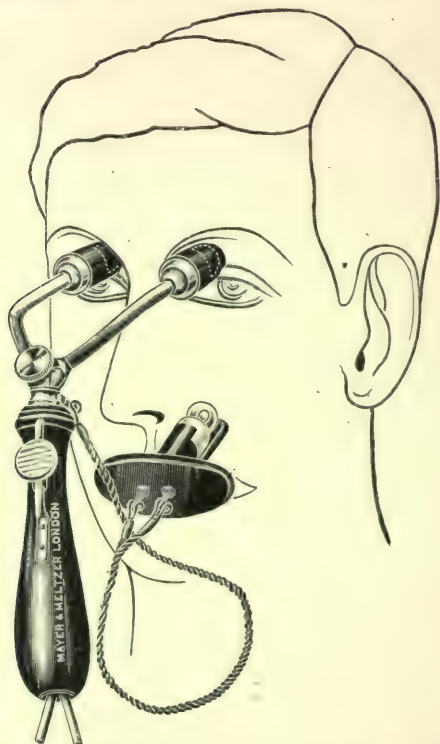


Fig. 106.—Roberts's lamp for comparing the transillumination of both frontal sinuses at the same time. The maxillary antrum lamp is also shown in the figure.

Electric Transillumination, by the method of Vohsen, assists diagnosis by excluding frontal sinusitis in some cases. The patient being in an absolutely dark room, a small electric lamp is placed as deeply as possible under the floor of the sinus, in the upper internal angle of the orbit, first on one side, then on the other. In the normal

subject, the region of the frontal sinus is often lit up by a diffuse pink light extending a little beyond the median line, but when the frontal sinus is full of pus, this region remains dark. If the suspected frontal sinus lights up well, it affords some evidence against the presence of pus; but if, on the other hand, the suspected sinus remains darker than the other side, the sign is of little value, inasmuch as the anterior walls are very often of unequal thickness.

Irrigation Test.—A frontal sinus catheter, after previous cocainization of the middle meatus, is passed up into the angle between the

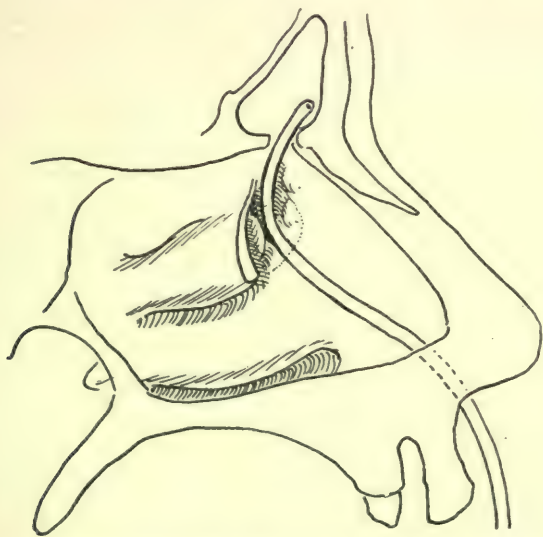


Fig. 107.—Showing a catheter passed into the frontal sinus; the proximal end lying close to the upper lip. The illustration also shows the curve of the author's catheter, which is like Symonds's, with the end more sharply curved, as in Hartmann's.

outer wall and the middle turbinal, and carried forwards until the point is felt to enter the infundibulum, when it is passed directly upwards, and upwards and slightly outwards, for about 1 cm., and then upwards and slightly forwards, so as to avoid entering the ostium of one of the anterior ethmoidal cells, if possible without using any force, until the part of the catheter outside the nose lies vertically against the upper lip. The catheter will then be lying well within any

anatomically normal sinus; but this can only be proved by a skiagram, as the catheter may have entered an enlarged fronto-ethmoidal cell, as demonstrated by StClair Thomson. As a rule, it is only after removal of the anterior end of the middle turbinal that this manipulation is possible, and even when the anterior portion of the middle

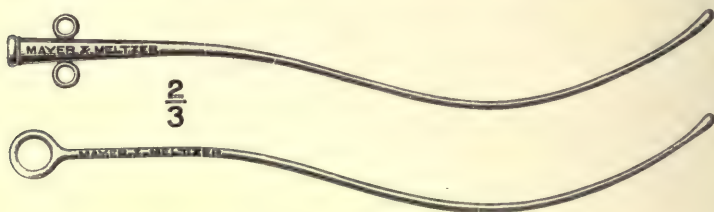


Fig. 108.—Symonds's frontal sinus cannula.

turbinal has been resected, it is impossible to make a probe enter the infundibulum in a large percentage of cases.

The frontal sinus catheter having been passed so as to enter the frontal sinus or frontonasal duct, may then be used for exploratory lavage, by attaching a tube and rubber bulb or a syringe to the proximal end. First it is well to blow in air, which will force any pus

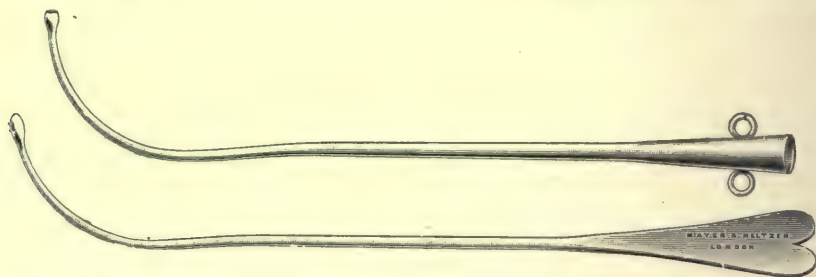


Fig. 109.—Hartmann's cannula for irrigation of the frontal sinus.

in the duct down the side of the catheter into the middle meatus. Then irrigate with a little clear, warm boracic acid solution, and note if the returning solution contains pus or is clear. Of course the nose, and especially the middle meatus, have been cleansed of all pus before passing the catheter, otherwise the results of inflation or irrigation are vitiated.

PLATE XV.

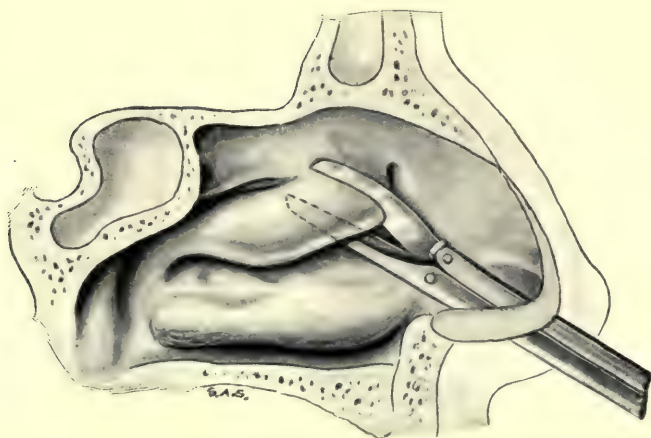


Fig. A.—Anterior middle turbinectomy: showing the method of dividing the anterior end of the middle turbinated bone near its attachment, prior to snaring off the divided portion.

Lent by Dr. H. TILLEY.

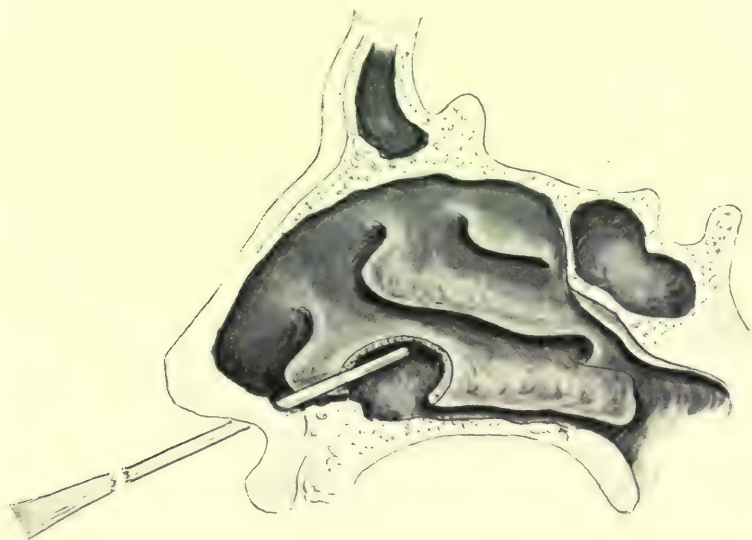


Fig. B.—To show the method of introducing a Lichtwitz trocar and cannula into the anterior cavity through the inferior meatus.

N.B.—In order to show the proper point of entry through the antro-meatal wall, a part of the inferior turbinal body has been removed, but no part of the turbinal body is cut or removed in practice.

The information is not conclusive, inasmuch as it is impossible to decide whether the pus washed out is from the frontal sinus or from the upper anterior or fronto-ethmoidal cells, but when such cells are the seat of suppuration it is seldom that the frontal sinus is not similarly involved.

The method of removing the anterior end of either a middle or inferior turbinal body is shown in *Plate XV, Fig. A*, and has been described on page 47.

Note that whereas the inferior turbinated bone springs out almost horizontally from the outer wall, the middle turbinated bone is a vertical plate.

Skiagraphy Test.—Finally, when the symptoms and various other tests corroborate the suspicion of frontal sinus suppuration, or when

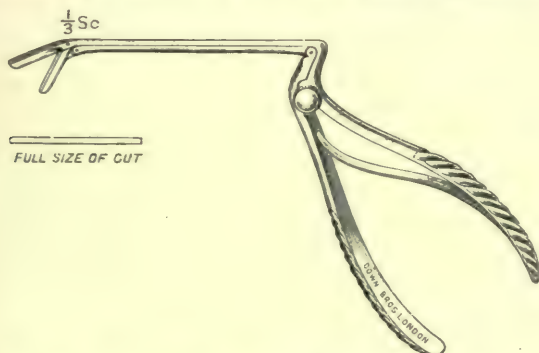


Fig. 110.—The author's down-cutting forceps for anterior middle turbinectomy.

the other tests leave room for doubt, a skiagram should be taken. Even when it is superfluous for diagnosis of pus in the frontal sinus, a skiagram should be made before performing a radical operation, as it affords most valuable information to the operator. It is essential that the X-ray plate should be crisp and clear, since for diagnostic purposes we rely on the relative fogginess in outline and indications of relative opacity to the rays of a suppurating sinus as compared with a healthy one. But no less helpful is the information afforded as to the size of the sinus, its upward and outward extent, whether the septum is median, or whether the sinus encroaches much on the opposite side. (See "SKIAGRAPHY OF THE NASAL ACCESSORY SINUSES," p. 197.)

ETHMOIDAL CELL DISEASE.

The division of the ethmoidal cells into two groups, viz., the anterior and posterior, has been described already, and we have seen (*vide Fig. 96, p. 171*) that the anterior group are associated clinically with antral and frontal sinus disease, while the posterior group are similarly associated with the sphenoidal sinus. The anterior group may further be sub-divided into :—

1. **The Inferior Cells**, including the bulla ethmoidalis, and cells opening immediately above it, and any cells in the middle spongy bone. The cells of this group are liable to become involved in inflammatory disease of the antrum, and cause polypoid degeneration in the middle meatus. They are not very difficult to reach, and may be opened up by intranasal methods without much difficulty.

2. **The Middle Cells**, just above the former, and lying to the inner side of the os planum, just below the level of the anterior ethmoidal canal. Great care is necessary in the operative treatment of these cells.

3. **The Fronto-ethmoidal Cells**, one or more forming the frontal bulla, when present. They lie around the ostium frontale below the floor of the nasal portion of the frontal sinus, some behind the frontonasal duct, some in front of the lacrymal bone; but all generally open into the infundibulum or frontonasal duct. These are the cells which are particularly prone to participate in frontal sinus empyema.

ANTERIOR ETHMOIDAL CELLS.

Symptoms.—The ethmoidal cells are very frequently the seat of inflammatory disease, catarrhal or purulent, probably more often than any of the other accessory cavities of the nose. Mucous polypi in the middle meatus are by no means rarely due to ethmoidal cell disease without involvement of the other sinuses. Again, the anterior cells are also very frequently implicated in association with antral or frontal sinus empyema. Closure of the ostia, however, is rare, and thus the large quantities of mucus, and the more definite or obvious symptoms due to concomitant suppuration in the larger cavities, often obscure the ethmoid cell affections, and result in their being overlooked.

The usual symptoms of inflammatory disease of the anterior cells are mucopurulent nasal discharge and stuffiness resembling a chronic cold in the head; pain and tenderness on pressure at the root of the nose, or extending outwards along the infra-orbital ridge to the temporal region, are not uncommon; and, though not usual, a deep-seated stupefying headache, torpor, dragging or aching at the back of

the orbit may be present. Sometimes the irritation of the nasal mucosa causes symptoms resembling hay fever—sneezing, and lacrymation, or external redness and tumefaction of the end of the nose.

When, as rarely happens, the cells become distended from retention of the secretions, the weakest wall yields, generally the lamina papyracea, and the eyeball is displaced outwards, diplopia resulting. Photophobia, lacrymation, and narrowing of the visual fields have been noted. A swelling forms on the inner corner of the orbit, often reddened and oedematous, and on pressure of this swelling the thinned bony wall may generally be felt to crepitate, and the pus is made to escape more freely into the nose. With the later involvement of the deeper layers of the mucous membrane erosion of the cell walls may occur, the pus becomes thicker, mixed with blood and sometimes bony particles, while epistaxis is not unusual. Though the pus is not usually very foetid, the patient complains of the smell.

Examination of the nasal passages generally reveals some boggy swelling and redness of the middle turbinal, and often pus may be seen in the middle meatus, which reappears slowly after cleansing of the parts with a cotton-wool pledget. Mucous polypi or oedematous granulations are commonly present, and after these are removed pus will often well out from the ostia. The middle turbinal itself may contain the suppurating cells, and it is then much enlarged as well as red and oedematous, and the bone softened; or the ethmoid bulla may be enlarged, distended, and covered with inflamed oedematous mucous membrane, and may fill up the anterior portion of the middle meatus, descending lower than the middle turbinal, for which it may be readily mistaken.

A probe introduced cautiously beneath the middle turbinal may reveal softened bone and bony spicules of formative osteitis.

By electric transillumination with a lamp in a normal subject an illuminated area will sometimes show on either side of the nose, and, according to Ruault and Robertson, ethmoidal cell disease is revealed by absence of the luminous spot on the affected side. The sign is of doubtful import.

Skiagrams sometimes show evidence of ethmoidal cell disease, but as the condition is more certainly and readily detected by direct rhinoscopic examination, it is hardly worth while to depend on the help of a skiagram.

THE POSTERIOR ETHMOIDAL CELLS.

The posterior ethmoidal cells are rarely the seat of isolated inflammatory disease, but the condition is often somewhat difficult to diagnose, and many cases are probably overlooked. A subjective sense of thickness over the right frontal region, loss of memory, deep-seated stupefying dull headache, a sense of inability to concentrate the attention or to think clearly, aching of the back of the eye and obscurity of vision, associated with discharge of pus posteriorly into the nose and the nasopharynx coming from the olfactory fissure, and (by posterior rhinoscopy, see *Plate XII*, *Figs. 2 and 3*) issuing above the posterior end of the middle turbinal, are usual symptoms, though sometimes the discharge is the dominant feature.

When the cells become distended from occlusion of the ostia, the eyeball is pushed forwards, or forwards and outwards, and suppurative orbital cellulitis, optic neuritis, etc., may occur. (See "OCULAR COMPLICATIONS," p. 204.)

Complications due to Purulent Ethmoiditis.—Apart from the complications resulting from extension of the diseased process to other accessory sinuses, suppuration in the ethmoid cell is liable to cause:—

- (a). By extension upwards, through the cribriform plate, meningo-meningitis, abscess in the anterior fossa of the skull, or in the frontal lobe of the cerebrum;
- (b). By extension towards the orbit, suppurative orbital cellulitis, and from involvement of the tear duct, dacryocystitis, epiphora, etc.
- (c). Purulent inflammation in the lacrymal duct, etc., may also arise from infection through the nasal orifice;
- (d). Eustachian catarrh, otitis media, catarrhal or purulent, with all its further possibilities, are liable to occur, especially in disease of the posterior ethmoidal cells.

Fortunately the inflammatory disease is often limited to the lower cells of the anterior group, and many of the more serious complications are then less prone to arise; nevertheless the extreme difficulty of deciding the extent of the disease, and especially of dealing effectually with the condition when the upper cells are involved, renders it necessary to regard every case as a serious menace to life, and requiring careful and thorough treatment. The differential diagnosis of sphenoidal sinus and posterior ethmoidal cell suppuration is not easy, and often diagnosis of the latter turns on exclusion of sphenoidal sinus disease.

SPHENOIDAL SINUSITIS.

Suppurative catarrh of the sphenoidal sinus is by no means a rare affection, and indeed is one of the commoner causes of post-nasal catarrh. When associated with caries of the body of the sphenoid it is probably due generally, though not necessarily, to syphilis or tuberculous disease. As the sphenoidal sinuses are anatomically posterior ethmoidal cells which have extended into the sphenoid and are sometimes replaced wholly or in part by ethmoidal cells, the symptoms of either set of cells overlap, and suppuration of the ethmoidal cells and sphenoidal sinus very often co-exist.

Symptoms.—If the pus escapes, indefinite central headache, with mental torpor and depression, vertigo, cacosmia, and obscurity of vision are usual symptoms. Dragging pain at the back of the eyeball is perhaps the most frequent complaint. The headache may be rather a sense of bursting in the centre of the head, or may be occipital, frontal, or temporal, and either central or unilateral or bilateral, whether, as is usually the case, one, or as more rarely happens, both, sinuses are involved.

The pus is usually discharged into the pharynx, and comes away most readily on rising in the morning, or on stooping. When the sphenoidal ostium is occluded, the bursting headache and neuralgic pains, the vertigo and mental depression, are very marked symptoms, together with febrile disturbance, rigors, etc.

The thin roof and outer walls of the sinus are apparently readily permeated by the infective organisms under the influence of pressure, when the pus cannot escape, and in this way inflammatory complications in the corresponding intracranial region are prone to arise. Hence choked disc, optic neuritis, and blindness from involvement of the optic chiasma and nerves may occur. From lateral distention, compression of the motor nerves to the eye may cause ptosis and strabismus, and (if amblyopia is not produced) the visual fields are generally contracted. (See OCULAR COMPLICATIONS, p. 204.) From compression or irritation of Meckel's ganglion, neuralgia of the fifth nerve may be severe.

Further complications may occur, such as suppurative meningitis, subdural or brain abscess, erosion of the carotid and other vessels, thrombosis in the cavernous sinus, and the usual symptoms that accompany these conditions. Not very rarely a severe pain is localized in the ear, and allusion has already been made to a patient under my

care who had severe pain in the ear which was perfectly healthy. Tilley also had a case of sphenoidal sinus disease in which severe pain in the ear had led a surgeon to advise a radical mastoid operation. He was able to reproduce the intense aural pain by pressure in the sphenoidal sinus with a cotton-wool probe. Two other cases of sphenoidal sinus suppuration with severe pain in the ear are referred to by StClair Thomson, and in both, competent surgeons were induced to open the mastoid to no purpose. Schech reports a case in which in addition there was excessive polyuria with a large amount of sugar. Mucous polypi may grow from the anterior wall of the sinus or in the superior meatus posteriorly, and the usual changes in the lining mucosa, fungous granulations, and polypi, and also rarefying osteitis, etc., are found in the cavities in old-standing cases.

The pus escaping from the sphenoidal ostium runs down the anterior surface of the sphenoidal turbinal, or down the speno-ethmoidal fissure, bathing the posterior ends of the middle turbinal, and may very often be seen by posterior rhinoscopy occupying the upper part of the choanæ narium and the fossæ of Rosenmüller and in the pharynx (see *Plate XII, Figs. 4 and 5*). Some of the pus usually finds its way into the olfactory fissure, and may then be seen on anterior inspection of the nasal passage, but far back in the olfactory fissure; only rarely can the pus be seen flowing from the sphenoidal ostium unless a portion of the middle turbinal has been previously removed or displaced. Though it mainly passes down the posterior wall of the pharynx, a good deal may descend to the nasal passages, when it is blown out by the patient. Thus some of my patients have affirmed that the pus came mostly from the front of the nose; it is therefore necessary to observe for oneself the location and flow of the pus and the direction it takes.

It is well here to point out again that the sphenoidal sinuses may have no aperture communicating directly with the rhinopharynx, as in a considerable percentage of subjects they open into the posterior ethmoidal cells.

Median Rhinoscopy.—It is often possible to obtain a view of the sphenoidal ostium by forcible distention of the nasal passage with a Killian's median rhinoscopy speculum under local anæsthesia. The instrument is passed so as to lie between the septum and the middle turbinal body, and then the blades are opened till the turbinal bone cracks and lies against the outer wall of the nasal passage. This

is a harmless procedure, as the turbinal subsequently returns more or less to its normal position.

The only way to diagnose sphenoidal empyema with certainty, unless one is fortunate in being able to see the natural opening with pus escaping, is to pass a cannula into the sinus and wash out pus : the method of performing this will be described below in discussing the treatment. (See p. 245)

Skiagrams.—A good lateral view of the sphenoidal sinus outline is usually obtainable in a skiagram, but though very useful when the question of operation arises, I have never succeeded in detecting evidence of disease or suppuration in the sinus by this method.

SKIAGRAPHY OF THE NASAL ACCESSORY SINUSES.

Skiagrams are valuable adjuncts in the diagnosis and treatment of frontal sinusitis and in the treatment of sphenoidal sinus suppuration ; but although it is sometimes possible to differentiate between healthy and diseased maxillary antra and ethmoidal cells by skiagrams, such pictures are of very little practical value, because we have at our disposal readier and much more certain means of diagnosis.

Skiagrams of the frontal sinus should be taken in two directions so as to afford (*a*) a postero-anterior view of the sinuses, and (*b*) a lateral view.

The patient may be lying on his back with the plate lying flat against the forehead, or he may lie with the face downwards on the plate. In the former position, which is usually the most comfortable, besides permitting of the use of the screen, the tube is below the couch, but with the patient lying on his face the tube must be placed vertically above the head. Some operators have the patient sitting up in a chair with a head-rest, the tube being behind the head.

Whatever position be chosen the technique is the same. To avoid the risk of X-ray dermatitis and other possible deeper effects of the rays, the target of the tube should be about eighteen inches from the occiput, and at any rate, unless the rays pass through the couch, some sort of protective filter, such as a very thin sheet of aluminium, should be interposed, and a cleaner, crisper negative is obtained if a condenser to cut off the lateral divergent rays is used.

It is important to have the head thrown back sufficiently to cause the rays to penetrate the back of the skull well above the occipital protuberance ; otherwise they have to pass through the thick bones

of the base of the skull, and this appears as a transverse shadow right across the frontal sinuses. If, on the other hand, the rays enter too high up on the occiput, they fall so obliquely on the plate that a distorted outline of the sinuses is registered. The best position is described more exactly below. For lateral skiagrams of the frontal and the sphenoidal sinus, the relative position of the patient's head, the tube, and the plate are the same, only the patient lies on one side.

Information afforded by skiagrams of the frontal sinus :—

1. Firstly, the presence or absence of a frontal sinus, their superficial extent upwards and laterally towards the external orbital angles, the position of the septum between the right and left sinus.

2. When a frontal sinus probe has been passed it is sometimes an open question whether the probe has actually entered the frontal sinus or a large and irregularly developed ethmoidal cell, until the skiagram affords conclusive proof.

3. The depth of the sinus from before backwards is an important point in determining beforehand whether it is possible to avoid unsightly depression after a radical operation.

4. In many cases of sinus suppuration a skiagram is of the greatest value for diagnostic purposes.

5. Lateral skiagrams may show the existence of orbito-ethmoidal cells which would have to be sought and opened up in a radical operation on the frontal sinus.

The lateral skiagram of the sphenoidal sinus is mainly of value as showing the size of the sinus, and if taken with a probe in situ, it is sometimes additionally useful to the operator to have clear proof that the probe has reached the posterior wall at its deepest point.

I have had very good results from stereoscopic skiagrams, which eliminate the confusing effects of ethmoidal cells lying one behind the other or encroaching on the frontal sinus. Certainly the stereoscopic skiagram is more easy to read in detail than the single plate. It is quite easy to make the stereoscopic skiagram. The first plate is taken in the usual way, and then, without the patient moving, the exposed plate is replaced by a fresh plate, and the tube is moved $2\frac{3}{4}$ inches to the right or the left, and a second exposure made. The two plates are then viewed in a Wheatstone stereoscope, or transparencies reduced to the ordinary size of a stereoscopic plate are made for the usual hand stereoscope.

To obtain good results with short exposures, it is essential to work with an efficient break, e.g., an electrolytic or a Sanax

mercury break, which can be used with a current of 275 volts off the main.

Caldwell,* of New York, who has had extensive experience in Röntgen-ray examination of the sinuses, states that :—

1. A frontal sinus exposure will require from twenty to fifty seconds with a tube which, for a skiagraph of a wrist or hand, will require one second or less. To lessen the strain on the tubes as much as possible, the fastest plates obtainable should be used.

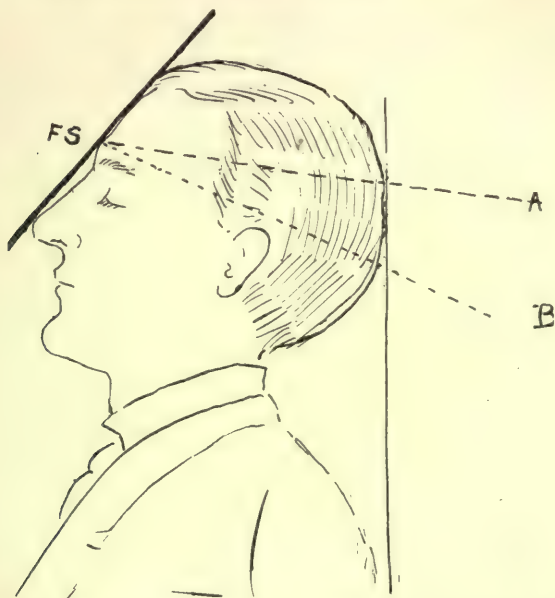


Fig. 111.—To show *A*—the good position—the principal ray passing through the skull above the occipital protuberance to the frontal sinus. *B*—the bad position for the tube, as the principal ray passes right through the occiput and base of skull before it reaches the sinus.

2. Large tubes with eight-inch bulbs and very heavy targets are to be preferred to the more usual tubes on account of the longer exposures required in sinus work.

3. The best penetration is about 9 or 10 on the Benoist scale, for while the rays must be of high enough penetration to pass through

* *Laryngoscope*, Nov., 1908.

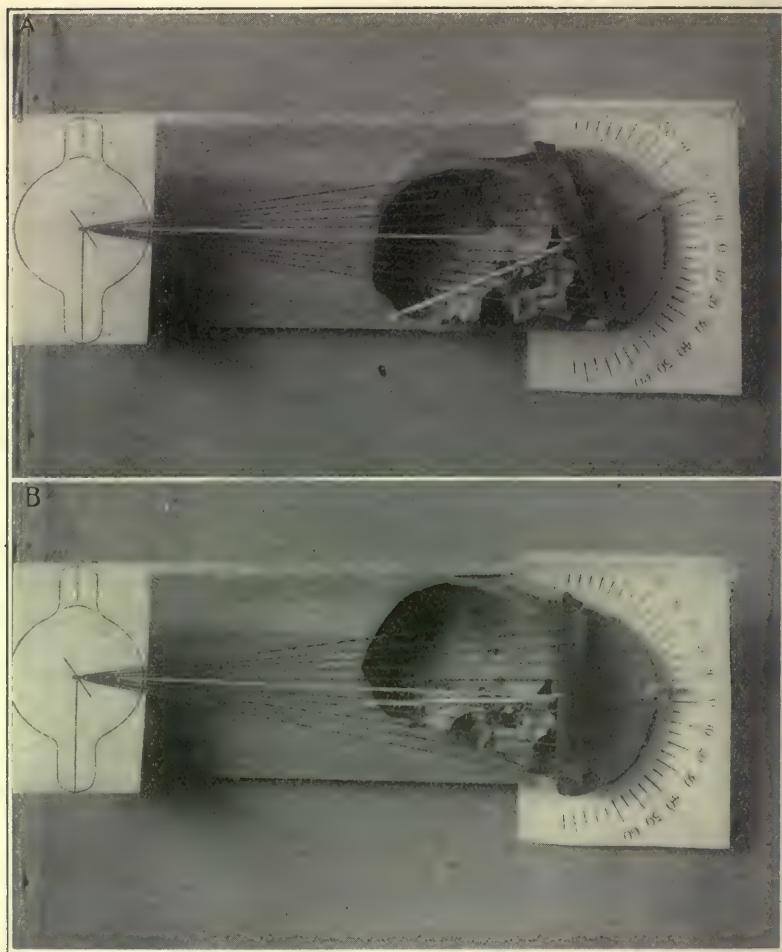
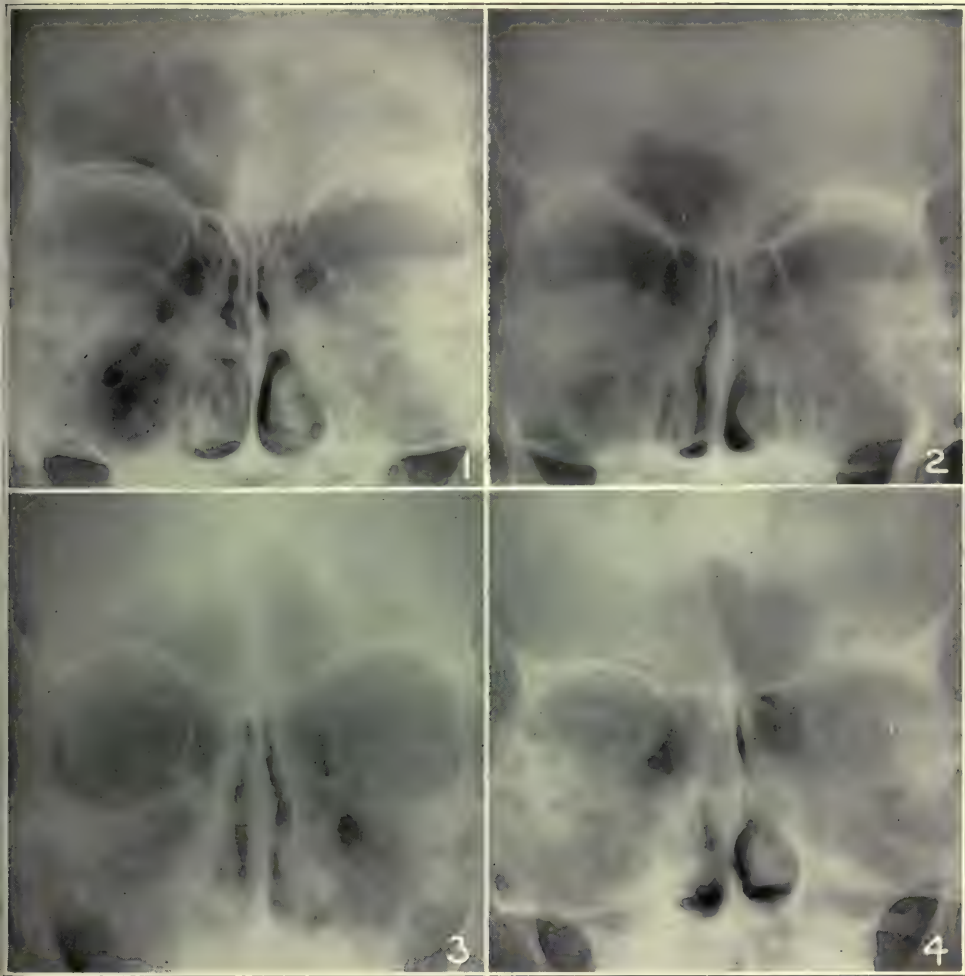


Fig. 112.—Two photographs of a model showing the effects of changing the position of the tube with reference to the skull. In A, the principal angle is approximately 25° , and it will be seen that the rays passing through the frontal sinus are not obstructed by irregular parts of the base of the skull. In B, the principal angle is too small (about 5°): therefore the shadows of the parts of the base of the skull would be superimposed upon those of the sinus.

PLATE XVI.

Lent by Dr E. W. Caldwell.



1. Very large frontal sinuses with many septa. Fluid is shown in right frontal and right maxillary sinuses, the fluid being pus.

2. Frontal sinuses rather large, but contain no fluid.

3. Asymmetrical frontal sinuses. In this case transillumination was misleading. The principal angle is a little too small, and the shadows of the petrous bones are shown over the lower third of the orbit.

4. Left frontal and both maxillary sinuses filled with pus. Principal angle a little too small for best results.

CALDWELL.

the skull and brain, rays of too high penetration will not give the contrasts that are necessary.

4. Developers giving density are to be preferred. His best results have been obtained with pyrogallie acid, next to which he prefers hydroquinone.

5. "In most cases the proper direction of rays, for the antero-posterior projection, may be obtained with sufficient accuracy by placing the tube so that the glabella, the parietal eminences, and the target of the tube are approximately in the same plane, the source of rays, of course, lying in the mesial plane of the skull."

6. "The knowledge of the antero-posterior depth of the frontal sinus, obtained from the transverse projection, is often useful in arriving at a correct interpretation of the antero-posterior projection. If the sinuses are deep, the quantity of fluid they may contain is greater, and the shadows cast by the fluid will be correspondingly stronger. When the sinuses are very shallow it will sometimes be impossible to decide whether they contain fluid. It has been proved that an œdematous lining membrane will cast as dense a shadow as a collection of pus or other fluid containing the same amount of water; and this should always be borne in mind."

Caldwell has conveniently termed the principal ray that ray which passes through the skull in the mesial plane and pierces the centre of the glabella. The basal plane passes through the centre of the external auditory meatus and the centre of the glabella, and the angle between the basal plane and the principal ray Caldwell has termed the principal angle.

AFFECTIONS OF THE EYE—OCULAR AND ORBITAL— DUE TO INTRANASAL AND ACCESSORY SINUS DISEASE.

As a consequence of the intimate anatomical relations of the orbit and nasal passages, eye complications are very frequently encountered in patients with certain diseases of the nose, and more particularly with suppurations in the accessory sinuses. These eye complications fall into four groups: (1) *Reflex nervous affections*; (2) *Mechanical displacement of structures*; (3) *Direct septic infection of the orbit or its contents*; (4) *Traumatic ocular complications*.

I. **Reflex Nervous Affections.**—As an example of the physiological association between the eye and nose we may recall the conjunctival

suffusion and flow of tears that accompanies sneezing, or on the other hand the sneezing and rhinorrhœa that are often set up by very bright sunlight. It is probable, too, that some of the milder eye affections commonly due to maxillary sinus suppuration, such as "dimness of vision for minute work," conjunctival suffusion, and so forth, are examples of reflex irritation of the sympathetic fibres in Meckel's ganglion affecting the sympathetic branch in the lenticular ganglion. Again, a moderate degree of œdema of the lids is frequently seen, especially in the nasal side of the upper eyelid in fronto-ethmoidal sinusitis; probably this condition is due to vasomotor disturbances from irritation of the sympathetic branches connected with the ganglia of the fifth nerve. Posey draws attention to the non-inflammatory nature of this simple œdema, which is to be distinguished from inflammatory thickening of the lid in cellulitis. Although all these reflex vasomotor phenomena are mainly of diagnostic import and not in themselves serious, it is well to emphasize their true character, as they are prone to give rise to the suspicion of the much more dangerous septic complications.

2. **Displacement of an Eye**, with consequent strabismus, may result from distention of the accessory sinus in closed empyema. A mucocele or a frontal sinus empyema may displace the eye downwards and outwards; distention of ethmoid cells with protrusion of the orbital plate displaces the eye outwards. Upward distention of the roof of the maxillary antrum, usually due to a mucocele or a malignant growth, will displace the eye upwards. Proptosis may result from cavernous sinus thrombosis, and extension along the ophthalmic veins, or from retrobulbar abscess, while of course necrosis of the orbital wall from ethmoidal disease will cause an abscess with displacement.

3. **Direct Septic Infection.**—The important bearing of sinus suppuration on the occurrence of orbital cellulitis, etc., has been well summarized by StClair Thomson, Jameson Evans, Fish, Stephenson, and Howell Evans in the *Ophthalmoscope*, Vol. VI, No. 4. Thomson reminds us that "we still read of orbital cellulitis coming on 'spontaneously,' and of its being followed by periostitis, abscess, caries, and necrosis. Now the experience of the rhinologist is that it is not the cellulitis that results in periostitis, abscess, etc., but that a septic process in these neighbouring nasal cavities is the primary lesion." Fish, who records twenty-six cases, states that "a purulent nasal discharge is very frequently wanting in the sinus ocular cases."

It was exceptional in the cases he records, and he strongly emphasizes "the fact that an absolutely negative nasal finding does not exclude accessory sinus disease."

The most important research bearing on this question is that of Onodi (*Die Sehnerv und Nebenhöle der Nase*). He shows (1) That not only the sphenoidal sinus but also the posterior ethmoidal cells may be in direct relationship with the optic nerve canal, and that such relationship may be homolateral, contralateral, or bilateral; (2) That both a sphenoidal sinus and a posterior ethmoid cell may be in relation to the optic nerve in the same subject; (3) That the maxillary antrum and sphenoidal sinus may come into direct relationship; (4) That the frontal sinus may extend backwards and the foramen opticum or the frontal sinus may open into ethmoid cells which extend back to the optic canal; (5) That the bone cysts in the superior turbinal may have direct relationship to the optic canal; (6) That bony dehiscences may promote transmission of infective disease to the orbit or optic canal, either by direct contiguity or by implication of blood vessels. He directs attention to the venous plexuses of the nasal accessory cavities, and the bearing that their communications have in the transmission of infective processes.

4. Traumatic Ocular Complications.—Consideration of the anatomical irregularities in the relationship of the optic canal to the sphenoidal sinuses and posterior ethmoidal cells, to which attention was drawn on page 25, and which are figured in *Plates VI to IX*, sufficiently explains the danger of operations on these regions and the necessity for caution. A case of permanent blindness following curettement of the ethmoid cells for nasal polypus has been brought to the knowledge of the writer, and two instances of permanent blindness following operation on the nose have been recorded by Laas—one an operation for a septal spine which was chiselled away, the other the removal of a small septal exostosis removed easily by a motor saw, the small operation being done under local anæsthesia and lasting only a minute. Onodi has also referred to instances of traumatic lesions of the optic nerve in its canal from the use of hammer and chisel, in operations on the sinuses. Less serious traumatic orbital complications of operations on the ethmoidal cells are relatively frequent, and it is not very unusual for considerable hæmorrhage into the orbit to follow radical operations on the ethmoid cells. When the cellular contents for which operation was required are septic, orbital abscess may result. Minute cracks produced in the lamina

papyracea may result in surgical emphysema of the orbit and lids if the patient blows his nose shortly after operation.

OCULAR COMPLICATIONS OF DISEASE IN THE DIFFERENT ACCESSORY SINUSES.

With these brief notes on the four groups of eye complications of accessory sinus disease, we may turn to the consideration of the complications that are prone to arise in connection with each particular cavity.

Maxillary Antral Disease.—Apart from the blurred vision and conjunctival suffusion, suppuration in the maxillary antrum alone is not so often a cause of eye complications as is suppuration in the ethmoidal labyrinth, but Evans finds that "orbital cellulitis is not an uncommon complication of antral disease, and the optic nerve is very liable to be damaged in consequence." The same author records a rare instance of optic neuritis, without any other inflammatory changes in the orbit, due to maxillary empyema alone.

Anterior Ethmoidal Suppuration is more prone to cause affections of the orbit and eyelids than of the eye itself. Reference has already been made to the vasomotor œdema of the lids from this cause, but another class of cases described by Posey are those designated "pre-lacrymal abscess," the term by which he refers to the swelling which sometimes forms above the internal palpebral ligament, somewhat external to the lacrymal sac. These pre-lacrymal abscesses, which are sometimes mistaken for abscess of the sac itself, are often due to necrosis of the lacrymo-ethmoidal cells, or to a frontal sinus suppuration pointing here.

• **Frontal Sinus Suppuration** is usually associated with suppuration in the fronto-ethmoidal cells, and very frequently with more or less implication of the whole anterior group. Although the main source of suppuration and the most striking symptoms may centre in the frontal sinus, it is the suppuration in the ethmoidal labyrinth which appears to be the essential cause of orbital complications, which take the form of inflammatory œdema in the lids, especially on the nasal side, or the formation of an abscess with necrosis of the orbital wall. In one case StClair Thomson records that "there was no swelling or œdema of the eyelid, but a congested wine-like staining of all the upper eyelid and around the inner canthus, where there was a fistulous opening secreting pus. A probe entered this for one inch, and bare

bone was felt." I have met with cases which developed a localized facial erysipelas from suppuration in the ethmoidal labyrinth, and in one case it developed into an abscess just below the lower lid.

Posterior Ethmoidal and Sphenoidal Sinus Suppuration.—The eye complications resulting from suppuration in these cells must be grouped together, not only because suppurations often co-exist in both groups, but because the posterior portion of the ethmoid labyrinth and the sphenoidal sinus have this common feature, that both are often in direct relation with the optic nerve. Jameson Evans states that "most of the cases that come to the ophthalmic surgeon complain of the loss of sight in one eye, and often pain around and behind the eye. Examination of the fields of vision may show that the reduced visual acuity is associated with a central scotoma, or a defect in one or both fields on the temporal or nasal sides." A choked disc or ordinary conditions associated with acute bulbar neuritis may be found, but the examination of the fundus may be negative; Posey, however, states that moderate degrees of neuritis may frequently be diagnosed by the distention of the lymph sheaths of the retinal vessels, and objectively by a diminution of light sense, and a sense of fullness in the eye with pain on rotation.

From the position of the optic chiasma and nerves, the nerves passing through the cavernous sinus, and the close proximity of the superior maxillary nerve and of its branches to Meckel's ganglion (*Plates VII and XXXII*), we can understand why congestion of the retinal veins, papillary stasis, oedema, atrophy and chemosis, paralysis of the ocular muscles (with consequent ptosis, strabismus), unilateral and bilateral temporal hemianopsia, and eventually cavernous sinus phlebitis and thrombosis or abscess, and exophthalmos, are liable to ensue. Vision may be good or visual fields contracted, or complete amaurosis may arise gradually or even suddenly, from thrombosis of the retinal vein. Panophthalmitis and destruction of the eyeball have been observed; but apart from such unfortunate complications, the failure to recognize the interdependence of the ocular manifestations and accessory sinus disease has led to unnecessary enucleations of the eyeball. Fish refers to several such instances coming under his notice.

It is remarkable, however, that definite external muscle paralysis may arise without other ocular symptoms. Thus Bryan relates a case of sphenoidal sinus disease in which there was paralysis of both external recti but no other changes, and no pain in the eye. I have

spoken of these graver ocular lesions as being due to sphenoidal sinus disease, but they may one and all equally be caused by posterior ethmoidal cell suppuration, for Onodi has shown that these cells are not seldom in direct relation with the cavernous sinus and the optic nerve or optic chiasma.

It is worthy of note, too, as demonstrated by Onodi, that the sphenoidal sinus or the posterior ethmoid cells of *one side*, may be in

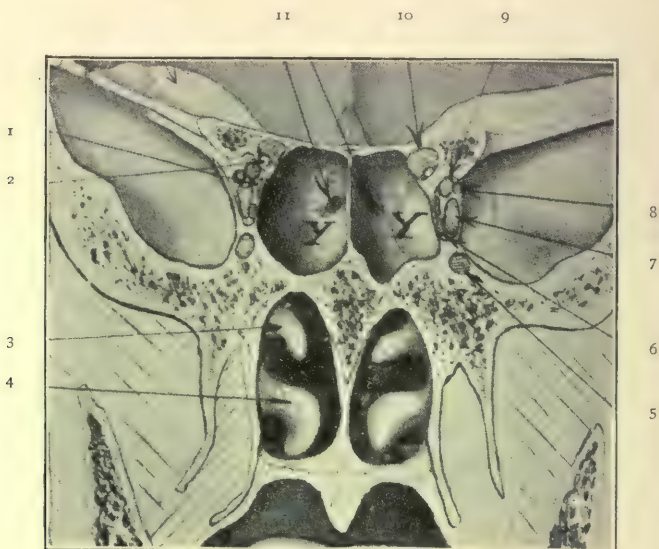


Fig. 113—Frozen section of the sphenoidal sinuses and its anatomical relations (HOLMES).

- (1) Ophthalmic vein; (2) Ophthalmic artery; (3 and 4) Middle and inferior turbinals; (5) 5th nerve, and div.; (6) 6th nerve; (7) 5th nerve, 1st div.; (8) 4th nerve; (9) 3rd nerve; (10) Optic nerve and ophthalmic artery; (11) Ostia sphenoidale; in Y the sphenoidal sinuses.

direct relationship with the optic nerve canal, or optic chiasma, of *both sides*, being separated by a shell of bone as thin as paper; and thus one may explain cases where one-sided ethmoidal or sphenoidal empyema has caused blindness or other ocular disturbances on the *opposite*, i.e. the healthy side, of the nose.

It is not until the intracranial extension of the infection and inflammation supervenes that the various nerves in and around the

cavernous sinus, and in close proximity to the roof or below the sinus, give definite indications of being involved.

Posey's classification of the ocular symptoms in a number of cases recorded or collected by this author, is in itself sufficient to emphasize the very various pathological conditions of the eye that have been shown to result from a hitherto unsuspected nasal affection.

1. Changes in the orbit.
2. Affections of the Lacrymal Apparatus.
3. " " " Lids.
4. " " " Extra-ocular muscles.
5. " " " Conjunctiva.
6. " " " Cornea.
7. Papillary changes.
8. Affections of the Uveal Tract.
9. Cataracts.
10. Reflections.
11. Asthenopia.
12. Disturbances in vision and the visual fields.
13. Headaches and neuralgia.

SECTION XIII.

*TREATMENT OF CHRONIC SUPPURATION IN THE
ACCESSORY SINUSES.*

ANTRAL SUPPURATION
FRONTAL SINUSITIS
FRONTO-ETHMOIDAL DISEASE

ETHMOIDAL CELL SUPPURATION
SPHENOIDAL SINUSITIS

INTRODUCTORY REMARKS.

THE diagnosis of suppuration in one or more of the accessory sinuses having been made, the question of treatment requires careful consideration, because the proper measure to be adopted for relief must depend on the particular cavity or cavities involved, the acuteness and severity of the symptoms, the age, sex, and occupation of the patient, and so forth.

For instance, if there be chronic suppuration in the maxillary antrum alone, it is a comparatively simple question, and as a rule one ought to try first to cure the patient by the simpler methods of drainage, resorting to a radical operation only if these fail. But when extensive ethmoidal cell suppuration and polypi co-exist, it is generally better to operate on the antral and ethmoid cell disease by more radical methods straight off, because simple drainage is much less likely to be successful, and it is easier to deal with the ethmoidal cells while doing the antral operation.

If frontal sinus suppuration as well as suppuration in the ethmoid cells and the antrum are present, we have to decide whether they shall all be done at the same time, or whether the antrum operation shall precede or follow the frontal sinus operation. On these points opinions differ, but for my own part I usually operate first on the antrum and ethmoidal cells, because by so doing one can almost invariably obtain good drainage for the frontal sinus and try the effect of free lavage; moreover the patient's condition improves from the

removal of the antral and ethmoidal suppurations, whereas if the frontal sinus is subjected to radical operation, leaving the antrum suppurating, the risk of complications arising in the frontal sinus area from infection by pus from the antrum is by no means inconsiderable. Again, it is a far greater ordeal for the patient to have a radical frontal sinus operation than an antral, and therefore the health should be improved first by the antral operation. But when the antrum and ethmoidal cells have been thoroughly dealt with, frontal sinus symptoms may subside to so great a degree that it may not be worth while exposing the patient to the discomfort and trouble of further operation. On the other hand, if the frontal sinus symptoms are so severe that immediate relief is called for, it is better to operate on all of these sinuses together.

One must further consider the size of a frontal sinus, especially in a female, as a large sinus would not be so readily submitted to operation as a small one: chiefly, because the risk of scarring and dangerous complications would be greater. Though a man would generally risk a scar to save long and troublesome treatment, a young woman would probably prefer to leave no stone unturned to avoid external operation, if there was a reasonable prospect of cure, or if the symptoms were not marked or troublesome.

Suppuration in the antrum, ethmoidal cells, and sphenoidal sinus should be followed up and cured, but with a free escape of secretion from the frontal sinus alone, in the absence of any complicating feature and when there are no other symptoms, the patient as a rule does not run much risk, and at any rate in patients of advanced years the risk is often less than that of a severe operation, the necessity for which may never arise.

It is a good general rule to determine as far as possible how much it is *necessary* to do in the way of removing turbinals and opening up sinuses, bearing in mind that one ought to be as conservative as the nature of the case permits, and having completed the operation, to forego any further operative measures until sufficient time has passed to enable the full results of the operation to be fairly judged. There is sometimes a temptation to open more ethmoidal cells, or make a snip here and there, because the continuance of copious secretion and the swelling of the mucosa may give the impression that more ought to have been done. But provided the suppurating cavities have been laid open, time will often go far in obtaining spontaneous recovery.

TREATMENT OF CHRONIC ANTRAL SUPPURATION.

The treatment of cases of antral disease requires much care and perseverance on the part of both patient and attendant. In all methods the object is the same, viz., to evacuate the pus and cleanse the antral mucous membrane with some antiseptic and stimulating application. If any polypi or hypertrophies of the mucous membrane obstruct the natural orifice, these must first be removed.

There are several alternative methods of procedure :—

1. A few Rhinologists Irrigate through the Natural Opening.—

A special syringe with a curved nozzle or a Hartmann's or Killian's cannula is directed through the ostium and the solutions injected. If treatment is attempted through this orifice it may be enlarged, and the anterior portion of the middle turbinal may have to be removed so as to allow freer access. Good results have been obtained

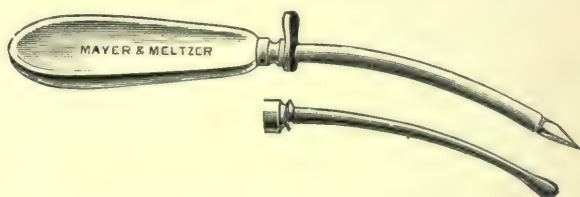


Fig. 114.—Krause's trocar and cannula ; and guide.

by daily irrigation through the natural opening into the antrum, but like the others mentioned, this is a tedious and very uncertain method. The same may be said of repeated irrigation by the daily introduction of a Lichtwitz's or Cresswell Baber's cannula through the inferior meatal wall, a method which, though advocated by a few rhinologists, I cannot recommend.

2. **By Irrigation through an Artificial Orifice** in the outer wall in the inferior meatus. Krause and Mickulicz introduced this method, and Freeman improved on their procedure by entering the antrum well towards the front.

Krause's curved trocar and cannula is a good instrument for perforating the wall of the meatus before enlarging with forceps. The trocar should be made to enter the antral cavity just below the nasal duct and close to the floor where the wall is thin, care being observed to prevent its suddenly impinging on and injuring the outer wall of the antrum.

Of late years the treatment of antral suppuration by entry through the antromeat wall has been further improved by making the opening large enough to enable the patient to irrigate it himself, and ensuring the opening being sufficiently large to remain unclosed, and above all by making the aperture well down to the level of the floor of the nasal passage.

In every case the anterior third of the inferior turbinal should be removed first, cutting with strong scissors near its attachment and snaring off the detached portion. Various methods of making the antromeat opening are in vogue. I use a curved cutting forceps with a sharp point which readily perforates the inferior meatal wall near the front of the antral cavity, and close to the floor of the nasal

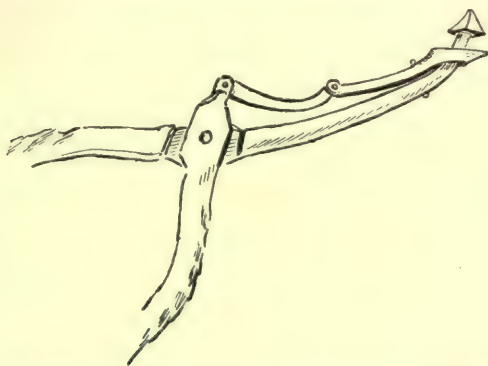


Fig. 115.—The author's cutting punch forceps for the intra-nasal operation.

passage, and then cutting in various directions till the opening is as large as desired.

Other instruments used for the same purpose are those of Lack, Carwardine, and Ostrom. Lack's strong curved knife is made to cut from behind forwards just below the line of attachment of the removed part of the inferior turbinal to the antral meatal wall, a second correspondingly horizontal cut being made above the level of the nasal floor, and these two horizontal cuts are joined at the ends by two vertical cuts with another similar knife. The quadrilateral piece of antromeat wall is then detached and lifted out with forceps. Carwardine's forceps are four in number, one to cut forwards, one backwards, one upwards, and one downwards, so as to nibble away

the wall around the initial puncture. Again, the opening may be made with an electric cutting burr. The anterior end of the inferior turbinal having been removed, a fine burr is entered about $\frac{1}{4}$ inch behind the anterior end of the line of attachment and the detached part of the turbinal, and about $\frac{1}{4}$ inch above the nasal floor. A coarser burr may be used to enlarge the opening down to the floor. Vail's curved saw, which is entered through a perforation in the inferior meatal wall, may be used to cut a round hole, the ragged cut edge of the inferior turbinal being afterwards trimmed off. By whatever method, the result is to make a large opening near the floor of the

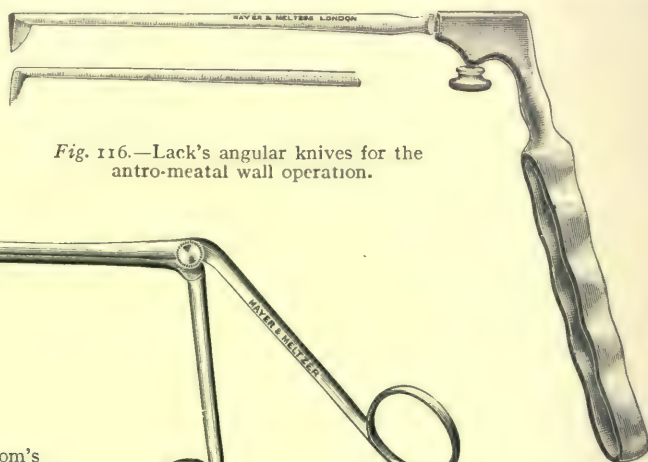


Fig. 116.—Lack's angular knives for the antro-meatal wall operation.

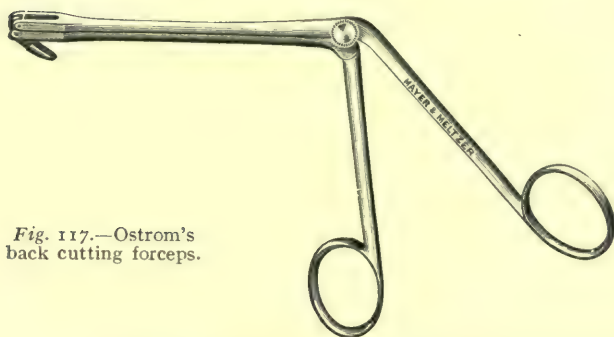


Fig. 117.—Ostrom's back cutting forceps.

nose, and it should be at least half an inch in diameter in any direction, and through this the cavity may be partially curetted if necessary, and irrigated daily.

3. **By an Opening into the Antrum through the Alveolus,** a method adopted by Cowper as far back as 1698. In many cases a carious upper molar is present, or the upper teeth corresponding to the affected antrum have been lost. The best point to drill through to enter the antrum is an outer socket of the first molar, but the second bicuspid or second molar socket may be entered if it is desirable

to retain the first molar, either because it is a sound tooth or because it is necessary for mastication.

The patient being anæsthetized by nitrous oxide, the tooth or stump is extracted, and the drill, firmly held in the hand, is made to enter the antrum through the outer border of the alveolus, being directed upwards and slightly inwards. If directed too much inwards or outwards, the narrow floor of the antrum may be missed, and in the former event the floor of the nose punctured instead. The drill should not be too fine; the larger holes give much less trouble than very small ones, which are apt to close up; therefore the drill should make a hole $\frac{3}{16}$ in. in diameter. The operation is usually simple

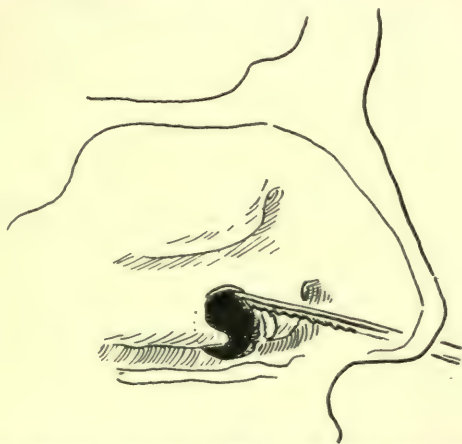


Fig. 118.—Intranasal operation on the antrum by Vail's curved saw.

and free from risk, though one case of alarming hæmorrhage, possibly due to angiomaticous condition of the lining mucosa, is reported by Scheppergrell.

The pus may well out of the opening thus made, but it is often necessary to wash out the antrum by injecting some warm water, the foetid secretion mixed with water running out of the nose. A still better plan is to inject a *few drops* of hydrogen peroxide, which, if it encounters pus in the antrum, at once causes a rush of foam into the middle meatus, and often at the newly-made alveolar opening. The quantity of hydrogen peroxide injected for diagnostic purposes should be small, because by throwing in enough to fill and overflow the

antrum into the nose it would at once foam up in the presence of pus in the nose itself, and its value for diagnostic purposes be lost.

The diagnosis having been corroborated by the finding of pus, the antrum is washed out thoroughly with some antiseptic lotion, and the peg inserted.

In my experience Ackland's instruments are the best for entering the antrum through the alveolus. They comprise: (1) A borer of special size, which readily cuts the bone of the alveolus when rotated forwards (like a screw); (2) A tube carrier, on which the antral tube fits; (3) A silver gilt antral tube, having a screw thread outside which retains it when *in situ*, and a "split-pin" stopper; and (4) A two-way nozzle, which fits into the tube when it is desired to wash out the antrum. A single-way straight tube may be used instead, flushing through the nasal opening.

Thorough syringing must be carried out, at first twice daily, then, as the amount of discharge diminishes, once a day, until the secretions

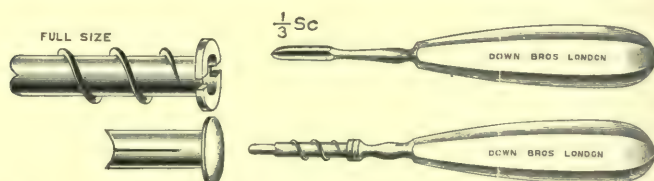


Fig. 119.—Ackland's antral empyema instruments.—For description see text.

have been free from pus and odour for at least a fortnight. In this way I have sometimes obtained a cure in a few weeks; but in other cases, the process of syringing the cavity daily may have to be continued for months before the unhealthy discharge disappears. The antiseptic solutions should be warmed before injection. I find it is a good plan to use a strong solution of peroxide of hydrogen (20 to 30 volume) to thoroughly cleanse the cavity first; it ferrets out every socket of curdy pus in a very short time. When the cavity has been well cleared, boracic acid, biniodide of mercury (1-4,000), iodine water, permanganate of potash, chloride of zinc (gr. 1 or 2 to the ounce), or common salt solution, may be injected until the lotion returns clear and free from odour. A solution of sterilla (1-20 to 1-60) is very good as an antiseptic douche, but is sometimes irritating if used in greater strength than one part to thirty of water. The combination of sodium chloride, borax, and sodium bicarbonate,

equal parts, mixed, a teaspoonful of the powder to a pint of warm water, has the advantage of being cheap, always obtainable, and very efficient.

Entry through the Canine Fossa.—This may be done under local anæsthesia, though it is more satisfactory to employ nitrous oxide gas or ethyl chloride anæsthesia. If cocaine is used, a 20 per cent solution is painted on the gingivo-labial fold, and then a few minims of 2 to 5 per cent solution injected under the mucous membrane.

The upper lip being well drawn up and back, an incision is made in the gingivo-labial angle, right down to the bone, extending horizontally from a point corresponding to the canine tooth to just in front of the zygomatic ridge, i.e., to the first molar tooth; then the periosteum and mucous membrane having been reflected, a hole from $\frac{5}{16}$ to $\frac{1}{2}$ in. in diameter is trephined into the antrum through the canine fossa, passing directly backward with a slightly upward direction.

Brown Kelly's trocars may be used instead of trephines; they are rapid in action, and cocaine anæsthesia suffices. The sharp trocar is entered about 5 mm. in front of the zygomatic ridge, and 5 mm. above the edge of the mucosa; the blunt trocar is made to enlarge and complete the opening. By means of an antral speculum rather smaller in diameter than the hole made, the interior of the antrum can be inspected, although Kelly recommends that the detailed examination be postponed till the following day, the wound being meanwhile packed with antiseptic gauze. Nearly the whole antral cavity except the anterior wall and the outer part of the roof can be inspected. If found to be healthy the opening can be allowed to close, which takes place rapidly, but if the mucosa is not too much degenerated it can be treated through the opening by irrigation or applications of various medicaments. Kelly found that chromic acid, fused on a probe and applied to not more than half of the antral surface at a sitting, was of much value.

The antral cavity should be thoroughly washed out with warm water, and when all pus and inspissated secretions have been removed, the interior of the cavity should be inspected. A rubber plug with a retaining swelling is well borne, and can be removed daily for irrigation or any subsequent inspection of the cavity.



Fig. 120.—The author's rubber antral plug and introducer (full size).

THE RADICAL ANTRAL OPERATION.

Formerly, the radical operation meant the operation associated with the names of Caldwell, Scanes Spicer, and more recently Luc; but the intranasal operation through the inferior part of the antro-meatal wall has been developed to such an extent that it also must be reckoned as one of the radical operative methods. Hence a radical operation on the antrum has come to mean an operation whereby the whole or a considerable portion of the lower part of the antro-meatal wall is removed, so as to establish a permanent opening from the antral cavity near the floor of the nasal passage, whereby permanent drainage is ensured.

The method introduced independently by Caldwell and Scanes Spicer in 1893 is a combination of the intranasal method with the

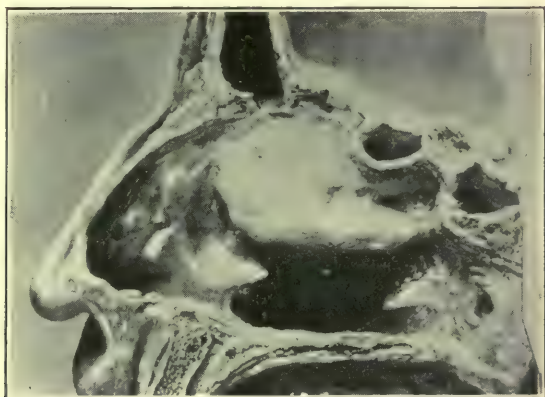


Fig. 121.—The Caldwell-Spicer-Luc radical antral operation.

canine fossa route. The special feature in this method is the immediate closure of the canine fossa opening, so that all the washing out and drainage is subsequently made through the opening in the inferior meatus.

Since the Caldwell-Spicer operation (usually but erroneously referred to as the Caldwell-Luc operation) was first introduced, it has been modified by later experience, not in principle but in important detail. An incision is made in the gingivo-labial fold extending from just in front of the zygomatic ridge forwards to a point corresponding

with the canine tooth. The periosteum is elevated above this for about $\frac{5}{8}$ in. The antrum is then opened by chiselling till an aperture is made large enough to admit the tip of a finger. If deemed necessary, the mucous membrane is curetted from the floor, any long ridges there are broken down, and all polypi removed from the cavity. If polypi are present in the middle meatus and on the unciform process, they are removed, and a large opening corresponding with the region of the natural ostium is made into the middle meatus. A handle burr and cutting forceps guided by the finger introduced equally high up in the nose are safe methods of making the opening.

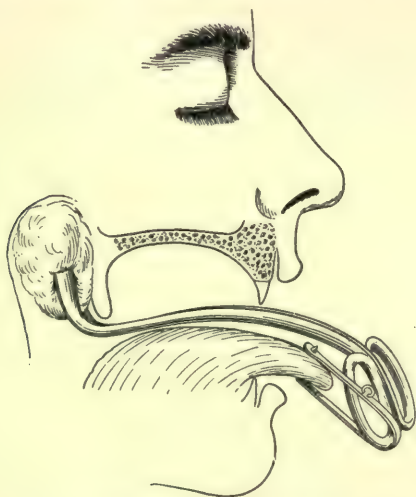


Fig. 122.—The author's post-nasal plug and tongue-hook for operations in the nose.

A chisel should be used with caution, because when directed through the canine fossa up to the upper part of the inner antral wall it is in a line with the cribriform plate, and if it slipped after passing into the middle meatus it might puncture the cribriform plate.

Finally, the removal of the lower part of the antromeatal septum has to be done by means of the hammer and chisel, the anterior third of the inferior turbinal being first excised through the nose. The opening made in this way should extend well down to the floor of the nose.

The Author's Method.—The patient is prepared for this as for all radical operations on suppurating nasal sinuses by thorough cleansing of the nose within an hour of the operation. The nasal passages, about half an hour before the anæsthetic is given, should be sprayed with a weak solution of cocaine and suprarenal extract solution, and as soon as the mucous membrane becomes partially anæsthetized the nose should be packed with gauze soaked in suprarenal extract, inserting it especially into the middle and inferior meatus. The patient is placed on the table and anæsthetized. The author's post-nasal plug* is then introduced, the packing removed from the nose,

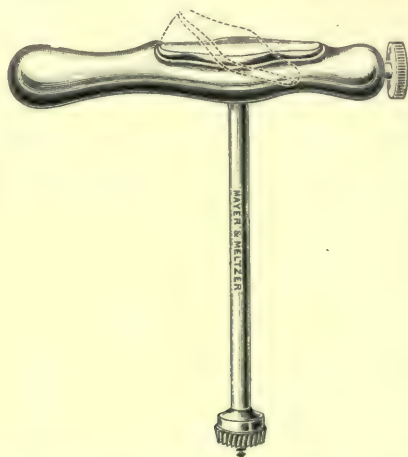


Fig. 123.—The author's antral trephine with gimblet-pin.

and a final spraying with suprarenal extract made. All polypi from the meatal regions are then removed; then, the patient lying on the back, an oblong gauze and wool pledget is passed well into the posterior angle inside the cheek, so as to prevent any blood escaping from the field of operation into the throat. The angle of the mouth is then drawn upwards, and outwards so as to expose the gingivolabial fold; the usual incision is then made, down to and incising the periosteum, which is raised with a periosteal elevator over the canine fossa. I simply trephine a sixpenny-sized opening in the

* Illustrated on p. 217.

canine fossa with my antral trephine, which has a gimblet-like pin, so that the circle of bone is retained within the trephine.

Every part of the cavity is accurately inspected, and one can at once see how much of the lining mucosa should be curetted and how much of the inner wall must be removed. Often one can thus avoid

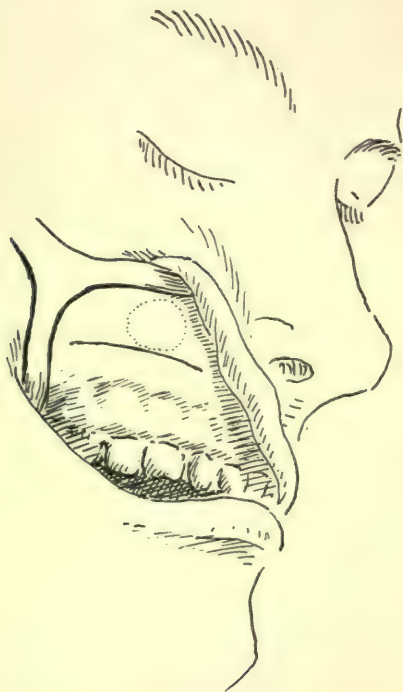


Fig 124.—To show the extent and position of the incision for opening the Antrum through the canine fossa, and the place where the entry into the antrum should be made, viz., well above the roots of the teeth, and corresponding to the space between the second bicuspid and the first molar tooth.

doing anything like a complete radical operation, while at the same time ensuring the complete removal of all polypi and diseased areas of bone, which is essential to successful results. The same trephine is then passed through the opening in the canine fossa till it is pressed against the portion in the anterior part of the lower meatus which

is to be removed. The tip of the forefinger of the free hand is passed into the nose, so that the septum is protected as the trephine cuts through into the nasal passage. In this way a perfectly round opening with smooth edges is made to connect the anterior and lowermost part of the antral cavity with the nose flush with its floor, no matter how thick the bony wall is at that point. (See *Plate XIV, Fig. B.*) The disc of bone and the *corresponding piece of the inferior turbinal* come away in the trephine. The anterior end of the inferior turbinal is not removed, excepting of course those cases in which it causes respiratory obstruction. This operation is relatively easy (I have done the whole operation in one minute from start to finish, and eight minutes is the usual time occupied in doing both antra), and it ensures the least possible removal of healthy tissues; in fact after the parts have healed, it is often very difficult, by simple inspection of the nasal passage, to see that anything has been done.

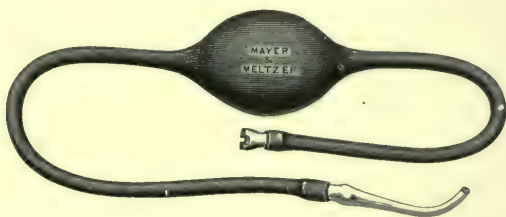


Fig 125.—Antral syringe with curved glass nozzle which enters the antro-meatal opening through the nose, for irrigation.

The $\frac{1}{2}$ -in. edges get smaller when the edges epithelialize over, but it never closes, whereas a smaller trephine opening contracts, and sometimes closes altogether. The opening into the mouth quickly closes, and after the first dressing all irrigation is carried out through the nose. It will be observed that this operation is essentially a modified Caldwell-Spicer-Luc operation.

Treatment of the Antral-mucosa.—Polypi should be picked off with forceps, and if the lining mucous membrane is much thickened and œdematous, scarification may be helpful, but unless degenerated beyond the possibility of recovery, it should not be extensively curetted, for with the improved conditions of free drainage it tends to recover a healthy condition, whereas a cavity lined with cicatricial tissue often gives rise to much subsequent discomfort.

After-treatment.—It is better not to pack the cavity, or, at any rate, if it is packed with gauze the packing should be removed the following day and not replaced. No suturing of the gingivo-labial incision is necessary, though many rhinologists put in one suture. I do not think it necessary, and am quite sure it does not accomplish any useful purpose, unless perhaps the incision has been very extensive.

Daily irrigation with some mild antiseptic lotion through the nasal opening should be carried out till the antral cavity is lined with healthy tissues. (*Formulae 24 to 26.*)

Lactic acid bacilli in emulsion are sometimes very helpful in overcoming the persistent infection of an antral cavity that has not been curetted, daily injection of a centimetre or more of emulsion, after the usual cleansing of the cavity, being continued for a week or two.

What are the Indications for each Method?—Individual opinions differ widely on this point, but speaking generally, the simple method of opening through the alveolus, if there is a suitable tooth diseased, otherwise through the canine fossa, should be first tried as a matter of routine, because drainage is established from the lowest point in the floor, and the patient can carry out lavage of the cavity himself, while the operation is readily done under nitrous oxide gas, without being followed by any notable pain. Many rhinologists decry these methods because they make the antrum communicate with the mouth, a septic cavity, while the antral secretion gets into the mouth and makes it foul. Personally I think the first objection is largely imaginary, because the antrum is already septic, and there is no evidence that the "septic" organisms found in a healthy mouth will excite suppuration in mucous membrane with intact surface. The second objection is easily got over by using a suitable plug which is only removed for irrigation. Even in very chronic cases a good result may often be obtained by the alveolar opening, but granulations and papilliform thickening of the mucous membrane are present in nearly all chronic cases; these are caused by the retained decomposing pus, and with the removal of the cause the mucous membrane may return to a healthier condition; but in a large number of cases this simple method of drainage fails, and the suppuration continues, the chief causes of failure being either (1) The extensive formation of polypi and papilliform thickenings of the mucous membrane of the cavity; or (2) The co-existence of purulent inflammation in the ethmoidal or frontal cavities, from which pus escapes into the corresponding maxillary antrum. It is then better

to resort to more radical methods of making a large opening through the antromental septum, either by the radical intranasal operation or by entry through the canine fossa.

We have now to consider the relative merits of the intranasal operation and those of Caldwell-Spicer and the one I have advocated, through the canine fossa. One of the drawbacks to the intranasal route is the impossibility of inspecting the condition of the antral mucosa, especially the inner antral wall, the most important of all. Hence one cannot tell how far curetting is called for, and the existence of polypi in the antrum may escape detection. Again, the removal of the most degenerated areas of mucous membrane and of polypoid conditions on the unciform process is rendered very difficult. Further, the intranasal operation is more difficult and takes longer than the method advocated by trephining the canine fossa, which method admits of close inspection and easy removal of any part of the inner antral wall, and so forth, and leaves an intranasal opening that is easily found by the patient for irrigation; moreover it does not necessitate removal of the anterior end of the inferior turbinal, which is left to protect the antral aperture and prevent its secretions running out of the anterior nares on stooping. The one and only drawback of the canine fossa method is that unless the opening is fairly high up and well behind the anterior end of the antrum, the nerves to the roots of the corresponding teeth are cut, and the teeth become "dead" teeth. I do not think the more extensive Caldwell-Spicer-Luc method offers any more advantages over the simplified method of trephining.

TREATMENT OF CHRONIC FRONTAL SINUS AND FRONTO-ETHMOIDAL SUPPURATION.

Although the main source of suppurative discharge may be the frontal sinus, it is rare to meet with suppuration restricted to a frontal sinus. Almost invariably there is more or less involvement of the anterior group of the ethmoidal cells which lie around and open into the infundibulum, and for this reason it is desirable to consider the treatment of these ethmoidal cells in conjunction with suppuration in the sinus proper. There is a further reason for including the anterior ethmoidal cells in this section, namely, that the frontal sinus is anatomically only a fronto-ethmoidal cell which has developed upwards between the two layers of the frontal bone, and the true frontal sinus

is very often encroached upon or more or less completely replaced by one or more of the true ethmoidal cells (middle group), a fact which often has to be reckoned with in operations on the frontal sinus.

Treatment may be referred to under three headings: (1) *Non-operative and palliative measures*; (2) *Irrigation and intranasal operative procedures to facilitate irrigation and drainage*; and (3) *External operations, and operations for obliterating the involved sinus*.

1. Non-operative and Palliative Methods.—In considering the treatment of frontal sinus as compared with antral suppuration, we cannot fail to note important differences in the conditions from a clinical standpoint, viz., that by a relatively simple operation, neither dangerous to life nor in any way affecting the facial appearance, an antral cavity can be opened, inspected, curetted, drained, and cured, whereas a frontal sinus cannot be opened to inspection except by an external operation, and that there is always a certain element of danger in such cases and of a more or less disfiguring scar in efficient operations for the eradication of frontal sinus suppuration. In a large proportion of frontal sinus suppurations there is obstruction to the escape of pus and drainage, either (*a*) from the anatomical arrangement of the ethmoid cells and the size and conformation of the frontonasal duct or of the infundibulum, or (*b*) from pathological developments, such as oedematous swelling or polypi in the course of the frontonasal channel of exit; and such conditions have to be dealt with by intranasal operations before proper drainage is established. But in a considerable percentage of patients the frontonasal duct is large, sometimes unusually large, and that there is no anatomical obstruction to the free escape of the pus can often be proved by the readiness with which a full-sized frontal sinus bougie (I do not refer to the much finer calibred frontal sinus catheter) enters the sinus from the nose. The latter group of cases seldom suffer from the most severe headaches, nor are they so prone to dangerous complications as are the patients in whom definite obstruction exists, though there is always the risk of polypi and other secondary developments arising. Then again, the age of a patient or the general enfeeblement of health may constitute a very serious bar to an external operation that may have to be a very much more serious procedure than is anticipated before the sinus is opened; hence the important rôle of non-operative measures in frontal sinus suppuration, and the need for carefully weighing the question whether it may not be better to be content with alleviating the symptoms rather than expose the patient to

the risks of anything like a radical operation, notwithstanding the fact that one may leave very little cosmetic defect from the external operations, and the mortality is low (I have been fortunate in never having had a death).

For the recurrent headaches due to exacerbations of the chronic sinus inflammation, nothing gives more relief than applying a sponge or lint wrung out of hot water, or poppy-head fomentations applied over the frontal sinuses. Inhalation of menthol in hot water (*Formula 3*) may be useful, and spraying the nose with cocaine and adrenalin solution, or gently douching the nose with hot water after spraying with cocaine or novocaine. In some chronic cases the supra-orbital pain is increased in cold weather, or even from being over-tired; then phenacetin, phenazone, bromide of ammonium, acetanilid, etc., may afford great relief. Particularly are female patients relieved from the increased pain that often corresponds with the menstrual period.

Vaccine Therapy, I think, is undoubtedly helpful in some cases, particularly when free drainage has been established, and moreover may be of service in clearing up the slighter secretions that sometimes persist after radical operation from the incomplete eradication of the infected areas of mucosa, especially in the involved ethmoidal labyrinth. But in sinus suppuration this method of treatment is generally useless without previous operation.

2. Irrigation and Intranasal Operative Procedures.—*Irrigation and Drainage.*—Irrigation is not alone a palliative method, for cases are recorded, and I myself have had cases, where continued and oft-repeated irrigation has resulted in a permanent cure. But there is good reason why irrigation is rarely successful, in that the frontal sinus, often as it is the seat of inflammatory disease and suppuration, generally drains and cures spontaneously, owing to the favourable position of the frontonasal channel for drainage, *unless anatomical conditions make this impossible*. Thus, if an anatomical condition permits of irrigation, the occurrence of chronic sinusitis is relatively rare, and where, with a fairly patent frontonasal duct, natural drainage has failed to prevent the sinusitis becoming chronic, it is usually due to pathological conditions which will render irrigation futile. Nevertheless, irrigation may succeed. Usually, it is necessary to remove the anterior end of the middle turbinal before a catheter can be passed, but this point is discussed below. For irrigation the following course may be commended. First wash out with a solution of peroxide of hydrogen, then with a simple alkaline solution; finally

with about 2 dr. of 8 to 10 per cent protargol solution, or a 1-4000 to 8000 solution of biniodide of mercury, or 1-10 sterilla soap solution. This process may be repeated daily or at intervals of two days to a week, weakening the antiseptic solution if it prove too irritating.

Intranasal Operations.—As a preliminary measure, any polypi or granulations in the middle meatus should be removed. Further, to gain access to the lower end of the infundibulum and to remove any possible obstruction here to free drainage, the anterior portion of the middle turbinated body—the operculum—should be removed. Either by the help of local anæsthesia or under nitrous oxide gas, the anterior third of the turbinated body is divided by bent scissors close to its attachment to the outer wall of the nose, and then separated by a strong wire snare or cut away by cutting forceps. (See p. 47.) The treatment of the frontal sinus may then be undertaken by the various intranasal methods.

Intranasal Operations on the Frontal Sinus.—The passage of a trocar or curette into the frontal sinus is a dangerous procedure, because even in healthy subjects the thin cribriform plate may be so easily perforated, and in some individuals the posterior wall of the frontal sinus is absent, or congenitally defective, so that there is no bony wall at all to prevent the instrument entering the cranial cavity.

We may recall Mermod's case in which meningo-encephalitis followed exploration of a supposed frontal sinus by a probe. It was proved post mortem that the frontal sinuses did not exist, and the liquid that had escaped by the nose during life could only have been cerebro-spinal fluid. There were two holes in the base of the anterior fossa, just behind the usual situation of the frontal sinuses.

We must remember, too, that the thin walls are sometimes softened or eroded in chronic empyema, and the passage of a trocar or probe, however carefully done, might then lead to complete perforation into the anterior fossa of the skull, and in a less degree the same objections apply to irrigation unless it is most cautiously and skilfully carried out. Whether a probe can or cannot be made to enter a frontal sinus depends on the anatomical construction of the parts, which we have seen is very variable in different individuals; for instance, Lothrop has pointed out that in more than 50 per cent of the specimens he examined a frontonasal duct did not exist, the ostium frontale opening almost directly into the middle meatus by means of little or no canal. Such sinuses are sometimes comparatively easy to probe and to irrigate, especially if entry into the frontal sinus is guided

and directed by the X-ray screen, as carried out by Spiess. Curettement of the sinus through the nose, however, is a most dangerous procedure, though it has been successfully carried out. Curettement of the *lower portion* of the passage between the sinus and the nose is less open to objection, and may greatly facilitate the irrigation.

A further objection to the intranasal method lies in the practical inability to attack by this route the very frequently associated ethmoidal-cell disease. Zückerkandl has stated that he has never met with a single case of isolated suppurative inflammation of the mucous membrane of the frontal sinus, and we have drawn attention to the frequency with which the fronto-ethmoidal cells are involved in either frontal sinus or ethmoidal cell suppuration; and, if untreated, they will be starting-points for a re-infection of the sinus.

The methods of Fletcher Ingals and of Max Halle appear to have proved successful in their hands. For my own part I regard such methods as too dangerous, and consider that we have far more satisfactory means of approaching the frontal sinus by external operation; for even if we concede that a free opening into the frontal sinus can be made without immediate risk to the patient by the Ingals operation, it is laying bare a bony channel to the invasion of virulent organisms, without removing the pyogenic mucous membrane which remains to perpetuate the flow of pus: in other words, this operation, while adding fresh risks, only ensures a free exit for the pus, which free exit often enough already exists, and which, when certainly present, very frequently fails to result in cure.

The instruments used for Ingals' operation include a pilot with detachable handle, pilot burr, shield, packer and applicator, and for special cases a pilot burr and guard of different form, and a gold self-retaining drainage tube. Syringes and a small silver Eustachian catheter are used for anæsthetizing and in after-treatment. *Pilot*.—The pilots or probes are three or four in number, 14.5 cms. in length, of varying sizes at their distal ends, and are made of steel. The stem of the pilot is 1.2 mm. in diameter, which is the proper size to fit the detachable handle. *Pilot burr*.—This instrument consists of a burr, with a hole about 2 mm. in diameter through its axis, attached by a hollow wire cable to a steel tube of the same size as the cable. The burr of this instrument is 6 mm. long and 6 mm. in diameter. It is firmly brazed to the wire cable. *Shield*.—The spiral tube shield is of proper size and length to slip over the tube and flexible cable of the pilot burr, to prevent the latter from injuring the Schneiderian

membrane when the burr is in operation. It is made of a thin band of steel. This instrument is also used for holding the drainage tube in position while the applicator is being withdrawn. As soon as the patient is properly anæsthetized, and the pilot tube introduced, the handle is removed from the pilot (or probe), and the hollow burr is slipped on over it and carried up to the lower orifice of the nasofrontal duct, the shield being pushed up with it so that the mucous membrane of the nares will not be injured by the rapid revolutions of the flexible

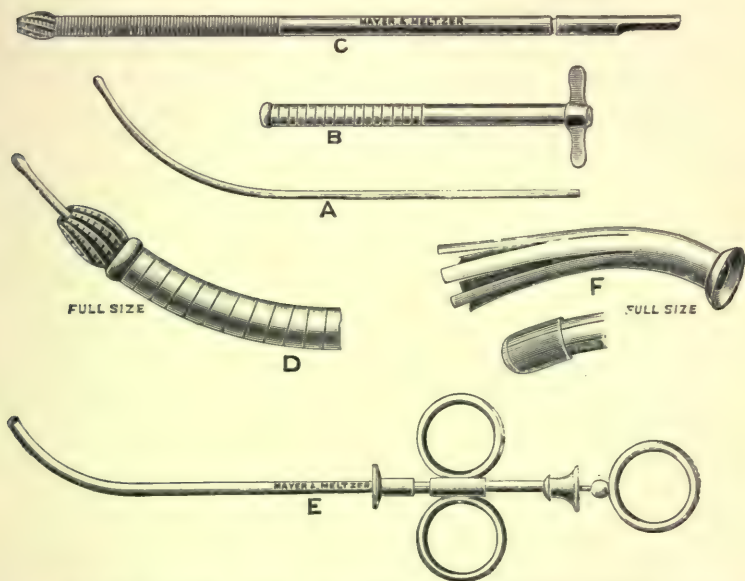


Fig. 126.—Fletcher Ingals' instruments for the intranasal operation on the frontal sinus. A, Pilot. B, Applicator. C, Pilot burr. D, Full size A, B, C. E, Packer. F, The drainage tube.

cable. The electric current is now turned on, and the burr is gently pressed upward. It usually cuts its way into the frontal sinus in two or three seconds. Ingals draws it back and presses it up again two or three times, to make sure that the canal is perfectly free, then withdrawing it and the pilot.

The patient must now be cautioned not to blow the nose for three or four days, because of the danger of causing emphysema about the eyelids, as in other cases where the ethmoid cells have been opened.

The packer is then introduced well into the enlarged canal, and through it the frontal sinus is packed with a strip of 1 inch sterile gauze saturated with a 20 per cent solution of chloride of zinc.

The spiral tube shield is next passed over the stem of the applicator, and then the gold drainage tube is slipped on the end of the instrument, and introduced into the enlarged drainage canal. The spiral tube shield is pushed up against the lower end of the gold tube, to hold it in position, the applicator is withdrawn, and the operation is finished.

Max Halle's instruments are somewhat similar, although he, of course, would consider they differ in essential particulars, for, with his grooved protector, there is perhaps less risk of injuring the posterior plate of the frontal bone.

3. External Operations.—Many different external operations on the frontal sinus have been devised and practised with varying success, and several of the more recently introduced operations are extensions and developments of those which represent the earlier efforts to overcome difficulties and dangers. The operative treatment of frontal sinus suppuration is in a transitional stage, consequently it is impossible to state what operations will eventually meet with the general approval of rhinologists, and methods still advocated by some practitioners are deemed antiquated by others. An endeavour will be made to indicate types of the various methods, reserving detailed description for a few of the more recent operations of the more radical type, and finally the advantages and relative merits of the different operations will be reviewed.

The various operations fall into groups, viz. :—

(a) Simple opening of the cavity and enlargement of the fronto-nasal duct.

(b) Opening the cavity, enlargement of the frontonasal duct, removal of the mucosa, and obliteration of the cavity by external drainage.

(c) Opening the cavity and removal of the anterior wall and floor of the sinus as well as of the mucosa, with intranasal drainage.

Ogston Operation.—In 1884 Ogston reported three cases he had operated on by making a vertical median incision extending from the root of the nose upwards for about one inch, exposing the anterior wall of the sinus by separation of the periosteum and soft tissues, trephining through the anterior wall so as to open the sinus. He then enlarged the frontonasal duct with a gouge and inserted a tube through into the nose for drainage, closing the external opening after

cleansing the cavity, the drainage tube being removed after one week.

Ogston-Luc Operation.—*Entry through the anterior surface*, the operation devised by Ogston in 1884, and independently revived by Luc in 1896, is now known as the Ogston-Luc operation. The eyebrow having been shaved, a curved incision is made along the inner third of the superior orbital margin, and carried down to the bone along the corresponding margin of the nose to the nasofrontal suture, and the periosteum having been reflected, the anterior wall of the sinus is perforated with a small trephine. The opening thus made is enlarged with cutting forceps to the size of a sixpence, or a $\frac{3}{8}$ -in. or larger trephine may be used to remove the bone, applied just above the supra-orbital ridge and internal to the vertical line corresponding to the inner canthus. The interior of the sinus is then exposed by incising the lining mucosa, examined, and explored in every direction with a probe, and the diseased, thickened mucous membrane freely curetted. To enable one to do this, it is usually necessary to enlarge the opening with bone forceps, but if the sinus does not extend laterally more than a few millimetres outside the trephine opening, such extension of the opening may be unnecessary. The subsequent steps in the operation apply equally whether the entry be made through the floor or the anterior wall.

If the two sinuses communicate, or if there is evidence of both sinuses being the seat of empyema, the septum should be completely broken down and the whole operation done on both sides. It is not safe to rely on both cavities being drained through one nasal duct. The probe should be passed into the nose through the nasofrontal duct, and then, with this as a guide, the posterior nares and rhinopharynx having being tamponed to prevent blood and pus running back into the larynx, a trocar should be passed down to the nose, or the duct may be freely curetted. Any bony obstruction here ought to be broken down, so as to ensure a free passage for future drainage into the nose. The floor should be attacked far back, as it is thinner here than in front. The ostium lies deeper than is generally believed; Tilley found that it may be as much as 28 mm. from the anterior surface. At this stage, if not already done, the condition of the frontal sinus and frontal-ethmoidal cells should be explored by the probe, and if softened or affording any indication of inflammatory disease, these too should be freely but cautiously removed in a downward direction, so that their free communication

with the enlarged frontonasal canal is ensured. A very free communication with the nose must be made; for however large the opening it tends to cicatrize and contract.

The whole cavity may be packed with a thin strip of antiseptic gauze, and the external wound closed except at its inner angle, which is left with one end of the gauze strip projecting. A strip of gauze, too, should previously be packed into the nasofrontal canal, the lower end projecting into the nose to facilitate removal. The presence of a drainage tube sometimes tends to excite the formation of granulations, which on removal of the tube cause stenosis and cicatrization. After twenty-four hours the gauze must be removed, and the sinus should be washed out daily with warm boracic acid, normal saline, or very weak biniodide of mercury solution.

As the secretion diminishes in amount, the irrigations may be made at longer intervals, till the sinus has remained free from purulent secretion for a week.

The operation often leaves no deformity at all, especially when the anterior wall has not had to be removed to any great extent. Ogston, as we have already stated, made a median incision from the root of the nose upwards, and a few operators still prefer this to the supra-orbital incision, the advantage urged being that a large trephine opening in the middle line enables one to explore both sinuses.

The modern radical operation on the frontal sinus has been further developed, and the simple opening into the sinus, and curetting of the mucous membrane and ethmoidal cells in the region of the frontonasal duct, has been replaced by methods which ensure the obliteration of the sinus.

Kuhnt's operation consisted in the complete removal of the anterior wall of the sinus, the remainder of the operation being the same as Ogston-Luc's; the essential point being that the soft tissues and skin were allowed to fall back on to the posterior wall. Obliteration was thus obtained, but the resulting deformity was very considerable indeed with any but quite small sinuses.

Riedel's operation was very similar, but he made an osteoplastic flap of the anterior wall and soft tissues, allowing them to fall back and connect with the posterior wall. (See *Plate XLI.*)

There are other modifications of the methods described, as regards the incisions, the amount of the wall removed, the treatment of the frontonasal passage, etc. While some advise complete removal of the anterior wall, aiming at complete obliteration of the sinus,

Jansen seeks to attain this end by removing the inferior surface of the sinus and making a large opening into the nasal fossa.

Many operators still adhere to older methods of draining the sinus through the external incision, but unless a sinus has already formed, it is undesirable to continue it for more than a few days, as the orifice left by the drainage tube often creates a fistula, which, in healing, leaves an unsightly puckering.

Entry through the inferior surface: An incision is made commencing from a point on the nasal process of the inferior maxilla, in front of the margin of the orbit at the level of the inner canthus and extending upwards and slightly outwards to meet the eyebrow, and then along the lower margin of the shaved eyebrow as far as the supra-orbital notch, the angular and supra-orbital arteries being divided. The periosteum and soft tissues are reflected downwards, so as to expose the orbital surface of the floor of the sinus, and with a small trephine or chisel and bone forceps an opening is made in the thin bony floor just above the internal angular process of the frontal bone. If, in chiselling through the bone, diploic bone is encountered here, it is certain that no frontal sinus exists at this point, and one should discontinue the operation, as it will only lead to exposure of the dura-mater. When the sinus, however, has been exposed, the lining membrane is incised and the cavity explored with a probe. As already mentioned, Jansen opens the sinus through the floor; he subsequently removes the whole of the sinus floor, cures the mucosa, and completes the operation by enlarging the infundibular passage as in the Ogston-Luc operation.

The chief difficulty in the after-treatment is to determine whether the cavity should be packed through an opening left in the brow incision. It is obvious that if the sinus is large and deep the removal of the anterior wall of the sinus, and allowing the skin and soft tissues to fall back on to the posterior wall, must leave some depression on the forehead corresponding to the sinus. Unless the sinus is large and deep it is certainly better not to pack, but if much depression is to be feared, I think it is better to pack the sinus through an opening left unsutured, and allow the cavity to granulate up. Much care, then, is needed to prevent the edges of the wound becoming inverted and dragged down towards the cavity by the contracting cicatricial tissue resulting.

To avoid ugly depressions or scars in the eyebrow, after packing, I have resorted to the following plan. After granulations are

appearing the packing is discontinued through the original incision in the brow, which is completely closed by sutures. A fresh transverse incision is then made at the highest point of the sinus area, and this is used for packing the cavity from above downwards. As the sinus is of course very shallow here, very little sinking in can take place, and if a small cicatrix is left when the sinus is finally closed and healed, it is easy to cut it away and leave no perceptible scar. A cicatrix in the eyebrow shows more than in the forehead, a depression shows less.

If a depression is left behind after the operation, it is possible to obliterate it by a hard paraffin wax injection, but this is not an easy matter, as the cicatricial tissue has usually to be divided so as to leave a potential space for the paraffin wax to lie in; and further, there is a greater risk of suppuration around the injected paraffin than when normal tissues are present.

The Author's Osteoplastic Method.—Inasmuch as it is essential to open the frontal sinus through the anterior wall, it is necessary to first ascertain the upward extent of the sinus. This can often be determined by the distance that a frontal sinus bougie or catheter can be passed through the infundibulum from the nose, but a much more valuable guide to the operator is afforded by a skiagram which, even if too indefinite in its indications for diagnostic purposes, should show very clearly the upward and outward extent of the sinuses.

In addition to the usual surgical methods of preparing the patient—disinfecting the skin of the operation area, and irrigation of the nasal passages, which of course apply to all the operations described—I find it is well to have a preliminary bacteriological investigation of the pus, and if streptococci are dominant organisms, 20 to 30 cc. of ANTISTREPTOCOCCIC SERUM should be injected the day before the operation.

The initial incision extends along the eyebrow towards the root of the nose, thence downwards along, or just outside, the middle line. The skin and soft tissues are raised upwards till 3 or 4 mm. of bone above the orbital margin is exposed, and then, the periosteum having been divided by an incision corresponding to that in the soft tissues, but at least 3 to 4 mm. higher up, the skin, soft tissues, and periosteum are raised together over the anterior surface of the frontal sinus, the size of which has been determined beforehand. The anterior wall of the sinus above the periosteal incision is next completely removed, i.e., to within 4 mm. or more of the floor. A second incision,

about $\frac{3}{4}$ in. long, along the inner and lower margin of the lacrymal groove, exposes the duct, which is then turned outwards, and with the author's punch forceps, or by a chisel or burr, entrance is made into the nasal passage through the bottom of the lacrymal groove. A fine curved saw having been passed through the nose so as to come out at this opening, is made to divide the nasal process of the maxillary bone. (By making the saw cut from below through the nasal process of the superior maxillary bone, the facial artery is not divided, and thus the main vascular supply to the flap is not cut off.) The above flap should be slightly wedge-shaped, so that it fits securely when replaced. As the bone is rather thick here, this and the final saw cut are made most easily with a Gigli saw, though I find it is better to begin the sawing with a special hand saw, so as to ensure the Gigli saw cut taking exactly the desired direction. The Gigli saw may be introduced by the aid of a curved pedicle needle or forceps.



Fig. 127.—The author's curved saw with "flegm" teeth for osteoplastic flap.

A second saw is next made, extending from the frontal sinus down to the lacrymal groove, dividing the bone from behind forwards, and leaving the soft tissues intact.

The first incision is then completed by means of a saw, extending right through into the frontonasal duct, and downwards so as to divide the nasal bone *near* the mid-line, but outside the attachment of the septum. The osteoplastic flap thus formed is then turned out, giving free access to the frontonasal passage and ethmoid cells. The plate of the middle turbinate body is seen running up to the outer margin of the cribriform plate, and forms a useful guide in operating on the ethmoidal cells which lie on the outer side. They can then be safely clipped away, if necessary right back to and including the sphenoidal sinus. This is done with caution, and the cavity is frequently sponged clear of blood, and bleeding controlled by adrenalin solution or peroxide of hydrogen tampons, so that the whole proceeding is guided by direct inspection, so as to avoid any risk of injury to an optic canal should it be crossing the upper or outer walls of a posterior ethmoidal cell. The whole of the pyogenic mucous membrane of the

frontal sinus, if it is a case of empyema, is then curetted away, and any ridges removed. Great care is taken that no remote pocket is left undenuded of the mucous membrane, and the whole cavity, after being



Fig. 128.—Diagram of the author's radical operation, to illustrate the method of forming the osteoplastic flap after the frontal sinus has been exposed.

1, The nasal process of superior maxillary bone being divided subcutaneously by the saw passed in through the nose so as to emerge at the opening in the lacrymal groove; 2 2, a Gigli saw, passed from above down the enlarged frontonasal duct so as to emerge at the lacrymal groove opening to divide the bone subcutaneously; 3, the osteoplastic flap which then results on the vertical division, by knife and saw, of the skin and bone near the mid-line, and which is then turned outwards like a doorway on a hinge; 4, the facial artery running up to 3, where it becomes the angular artery. As it courses inwards below the bony margin where the saw divides the nasal process, the artery is not injured, and the preserved vascular supply of the osteoplastic flap ensures its vitality and the rapid reunion of its cut edges.

cleaned out, is carefully inspected for any minute opening into an ethmoidal cell, which, if present, must be opened and cleaned out.

Unless for any reason it appears unnecessary or undesirable, the floor of the sinus is then removed to within a few millimetres of the orbital

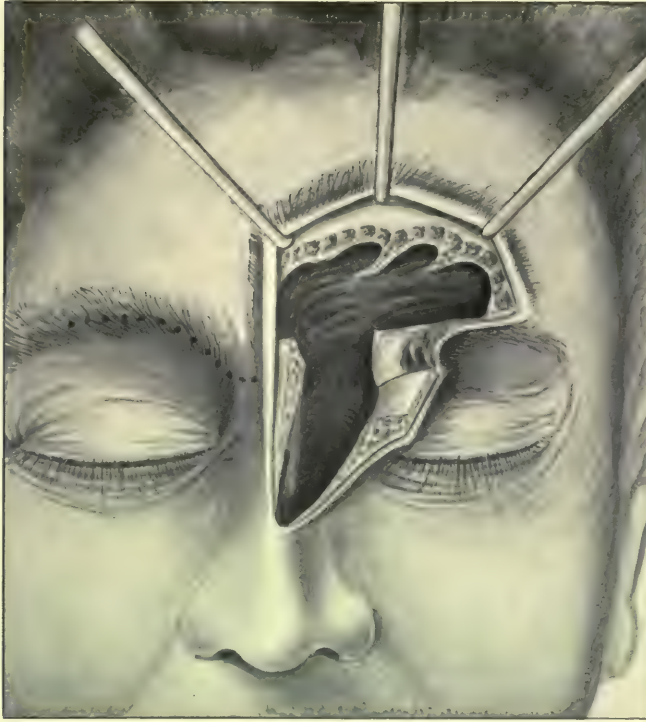


Fig. A.—The osteoplastic flap operation on the patient's left frontal sinus. The frontal sinus cleared of mucous membrane, bony septa, and the whole of the ethmoidal cells, as well as the orbital roof corresponding to the frontal sinus floor and the inner wall of the orbit in its upper half removed, exposing freely the sphenoidal sinus wall. Note on the nasal side of the wound the remains of the vertical plate of the middle turbinated body; on the inner side of this plate lies the narrow roof of the olfactory fissure—i.e., the cribriform plate. The vertical plate of the middle turbinal is preserved and used (a) as a guide in avoiding the danger area, and (b) to guard the cribriform plate from the purulent secretions, etc., from the operated area above during process of healing.



Figs. B and C.—Two patients on whom the operation had been performed on the left side. From untouched negatives, showing the absence of any facial defect or scarring.

margin, and also when necessary the inner wall of the orbit with the ethmoidal cells in imitation of the Killian operation. The osteoplastic flap is now examined for any small ethmoidal cell it may contain, and such being excluded or removed, the pyogenic membrane on its infundibular surface is carefully removed, and then the whole flap is finally replaced and the incisions sutured. If the bone flap does not fit securely in its original position, it is better to fix it by buried magnesium wire suture through the nasal bone or through the supra-orbital bone bracelet. This, however, is rarely necessary. It is usually safer to place a rubber drainage tube extending from the deepest to the most lateral point of the removed sinus through the remains of the frontonasal duct to the external nares. This may be

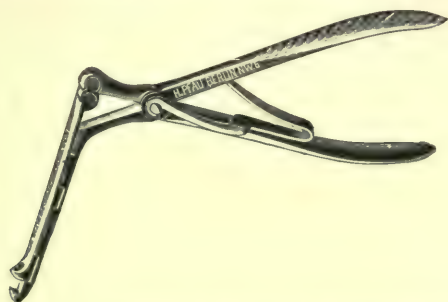


Fig. 129.—The author's bone-cutting forceps for opening the lacrymal groove.

removed about two to three days after operation and not replaced. For the first four days the passages may be cleansed by a nasal spray, but no douching is safe till after four or five days, and then it should be done cautiously. The patient must not be allowed to blow the nose for one week.

Killian's "Bridge Operation."—The incision begins at the temporal end of the unshaven eyebrow, and is carried right through it, running in a curve along the root of the nose, and ends in an oblique curve outwards somewhat below the base of the nasal bone. Without removing the periosteum the soft tissues are raised for some distance upwards over the anterior wall of the sinus, and downwards from the brow, and the periosteum is then incised 3 to 4 mm. above the margin of the orbit, the line corresponding to, though being higher up than, the initial incision of the skin, a second line of periosteal incision running along the lower border of the upper orbital margin. The

periosteum is then raised, with the soft tissues, above the line of the upper periosteal incision and downwards from the lower periosteal incision. The frontal sinus is then opened near the medial line, either above or below the bone flap marked out and remaining covered with periosteum, and without puncturing the lining mucous membrane the extent of the sinus is ascertained with a bent probe. The whole anterior frontal sinus wall above the bone flap is next removed, followed by careful erosion of the mucous membrane of the entire cavity. The bone of the floor is removed by chisel and bone forceps,

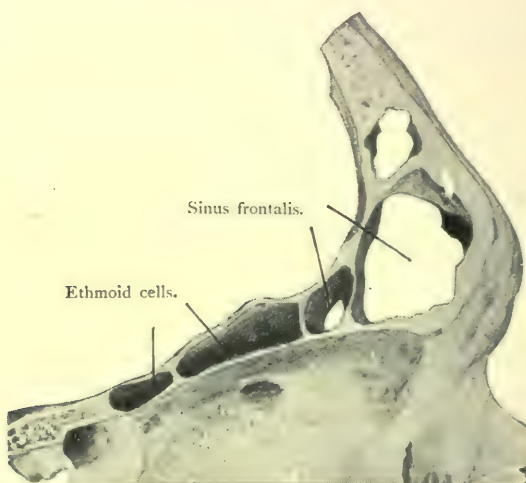


Fig. 130.—Frontal section through the right orbit, showing frontal sinus and ethmoid cells which have developed out over the orbit. The latter if suppurating would complicate an operation for frontal sinusitis unless specially sought for and opened up (Shambaugh).

sparing the bone flap included in the periosteal incisions. From the lower periosteal incision the periosteum is then detached from the nasal and lacrymal bones, and from the infra-orbital margin and roof of orbit. The frontal process is then trephined, and, without injuring the nasal mucosa, the bone is removed, making a wide opening in the frontal sinus floor; this makes it easy to remove the deeper parts of the sinus floor, the floor and walls of the temporal and orbital recesses, and then the anterior and middle ethmoidal cells; and after detachment of its mucous cover the corresponding part of the middle

PLATE XVIII.

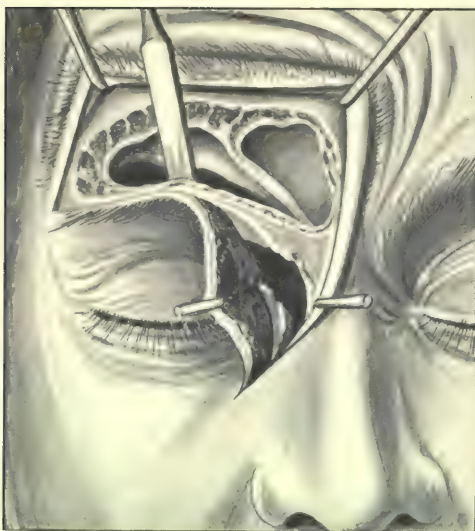


Fig. A.—Killian's radical frontal sinus operation (after Prof. Killian)

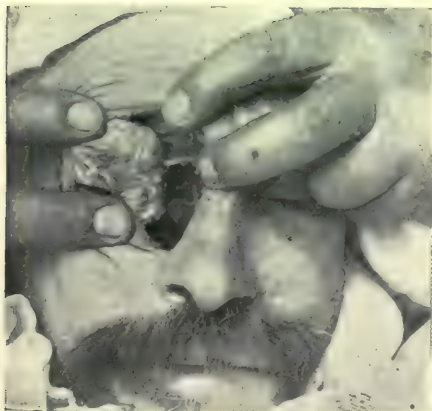


Fig. B.—Delsaux's operation after removal of the frontal sinus wall and of the ethmoidal cells.



Fig. C.—Delsaux's operation finished, showing line of incision, and how the parts come together again in this, Killian's, and the author's operations.

turbinate is removed, and when necessary the posterior ethmoid cells and sphenoidal sinus are laid open. Finally, after bleeding has ceased, and after careful inspection and removal of any remaining bony ridges, the wound is cleaned and any detached mucosa that is saved applied to the outer side of the resulting nasal passage, a tube inserted at the temporal end of the incision carried through the external nasal orifice, a nasal plug inserted, the skin carefully sutured, atropine dropped in the eye, and the bandages applied. The nasal plug is removed on the second, and the drainage tube on the third or fourth day. The nasal cavity is on no account to be flushed. (See *Plates XVIII and XLIII.*)

The use of aluminium bronze wire sutures, passed through the skin but without penetrating the subcuticular soft tissues, is recommended in order to lessen the risk of re-infecting the wound from the skin.

Delsaux's Operation.—Delsaux has devised a modification of Moure's operation for the removal of inalignant growths of the ethmoid, which he resorts to for the radical treatment of multiple sinus suppuration involving the frontal sinus, the ethmoid cells, maxillary antrum, etc. An incision down to the bone is made, extending from the centre of the brow along the internal angle of the orbit, descending on the lateral face of the nose till it reaches and terminates at the corresponding naso-labial depression. The periosteum is divided and detached upwards and downwards. Then the soft tissues over the frontal bone are detached, and the frontal sinus is opened with a gouge through the floor close to the nasal spine. The whole or part of the inferior and anterior walls of the frontal sinus is removed, according to the necessities of the case. The nasal bone and the ascending process of the superior maxillary bone are now removed, without at this stage opening through the nasal mucosa, so that the blood will not encumber the nasal passages. Of the anterior and middle ethmoidal cells sufficient is removed to ensure good drainage from the frontal sinus, and if the ethmoid is diseased that is extirpated too, care being taken to avoid wounding the ethmoidal vessels.

Behind one sees the sphenoidal sinus aperture. If its condition is doubtful this is explored, and if necessary the anterior wall removed. Unless previously removed, one now takes away with cutting forceps the middle turbinated body, and attacks the anterior, superior, and inner angle of the antrum of Highmore, and the interior of the antrum is curetted.

Lastly, the nose is pressed back in its place, and one proceeds to suture the divided tissues carefully. (See *Plates XVIII and XLV.*)

Delsaux has operated thus several times with excellent results, and "very little, if any, deformity." He has operated on two bilateral cases, and then he does not take away the nasal bones, so that, although the operation is less easy, one avoids the deformity that must result if both nasal bones are removed.

On the Choice of Operation for Chronic Frontal Sinus Suppuration.—Various considerations should influence the rhinologist in deciding whether any operation, except minor procedures such as anterior middle turbinectomy and other means for removing the intranasal obstructions to drainage, is advisable; these are mentioned on page 225.

Assuming that it is considered necessary to cure the patient by operation, the relative advantages, or otherwise, of the different methods may now be discussed.

The intranasal operations of Fletcher Ingals or of Lange are stated to succeed in a certain proportion of cases, but the fact that a free

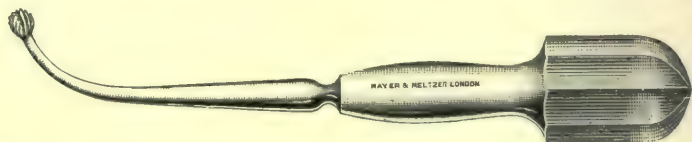


Fig. 131.—Tilley's small burr for breaking down the fronto-ethmoidal cells; it is passed from above downwards through the frontonasal duct.

drainage through the frontal nasal duct is frequently found to exist in frontal sinus suppuration without any artificial enlargement of the duct, proves that in such cases the disease could not be cured by these operations; and as the operations are undoubtedly dangerous, even in skilful hands, and cannot do more than enlarge the frontonasal duct, leaving untouched the whole expanse of pyogenic mucous membrane lining the cavity, as well as the ethmoid cells and suppurating diverticula which so frequently can only be detected when the cavity has been laid open, these intranasal methods have been very widely condemned.

An exploratory opening of the frontal sinus, which may be enlarged to half an inch in diameter, sufficient for good inspection of a relatively small sinus, affords space for enlarging from above downwards to the frontonasal duct and breaking down some of the suppurating anterior ethmoidal cells that may exist in its vicinity, thus accomplishing all that could be done by an intranasal operation more

efficiently and far more safely, while no external defect should result from the simple incision through the inner third of the eyebrow. This operation is what one adopts for acute sinus suppuration necessitating operative relief, and is often sufficient for the cure of sub-acute cases.

But in chronic suppuration of a frontal sinus the mucus membrane is generally diseased beyond the possibility of recovery, and nothing short of obliteration of the sinus will then cure the patient. The complete removal of the anterior wall, either temporarily or permanently, is essential, as it is impossible by any other means to gain access to the remotest corners of a sinus. The usual osteoplastic method, which seeks to avoid the depression resulting from permanent removal of the anterior wall, leaves the patient very liable to recurrence of suppuration, as it is obviously impossible to get complete apposition of the bared surfaces of the anterior and posterior walls, and even were this possible the depth of most sinuses involves a degree of depression of the detached anterior wall to meet the posterior which results in the very disfigurement which it is sought to avoid. The deformity resulting from the total removal of the anterior bony wall and the floor of the sinus, as in the operations of Delsaux, Kuhnt, and Riedel, renders such operations open to grave objections unless the sinus is small and shallow; but these operations have the advantage of completely obliterating the sinus without requiring any space to be filled up by subsequent granulation.

It is generally difficult to avoid an unsightly scar over the region of the external incision which is used for packing the sinus, but in some large sinuses the avoidance by this method of the depression of the supra-orbital skin and tissues, which otherwise must result, has certain advantages. The Ogston-Luc operation is still largely practised; the chief disadvantages lie in the difficulty of completely removing the suppurating ethmoid cells and in maintaining a patent frontonasal duct.

The procedure now most widely adopted is undoubtedly the Killian bridge-operation; it gives exceedingly good results, with little or no resulting cicatricial scarring or depression, except in cases where the sinus is very large and deep, and then there must be some, and sometimes considerable, depression above the supra-orbital bracelet. With these very large sinuses it may be better to pack through the external wound, so as to get the cavity to fill up with granulation tissue; such a procedure gives good results, but it takes some weeks to get the

cavity to granulate up. The disadvantages of the method are the risk of diplopia, from disturbance of the pulley of the oblique, the entry to the ethmoid cells from the side of the nose, the liability to keloid thickening of the scar at the side of the nose, and the tendency to persistent suppuration in the space behind the bridge, the so-called "dead space." It is obvious that the bridge and whole supra-orbital bony margin must prevent the soft tissues of the anterior wall coming into complete contact with the posterior wall, although this is to a large extent obviated by the orbital fat rising to fill the space, the frontal sinus floor having been removed. Diplopia, which is frequent after operation, almost invariably disappears after a time, and it may often be prevented by working round the point of attachment of the pulley when removing the orbital roof, and above all by avoiding extensive detachment of the orbital periosteum from the lower border of the upper orbital margin. Hajek, it will be observed, in his modification of Killian's operation, disregards the question of disturbing the pulley of the oblique and the attachment of the margin of the orbital periosteum, maintaining that the results are transitory as far as diplopia is concerned, while the larger and more external working space renders the operation much more easy of performance. The difference between Hajek's operation and Killian's is, however, one of convenience rather than of method, and personally I prefer Killian's, which has been very successful in nearly all the cases in which I have performed it.

My own osteoplastic operation (which I so designate to differentiate it from what is generally known as the osteoplastic operation) is much the same as Killian's, except that instead of leaving a bridge and removing the nasal processes of the frontal and superior maxillary bones and a portion of the lacrymal, I lift out temporarily the bone corresponding to the "bridge" and what is below it, and having completed the operation, replace the bone and save it. It certainly affords a very much wider and clearer operating space, giving free access to the sinus, the frontonasal duct, and the ethmoidal cells from the front instead of from the side; it lays open the whole length of the frontonasal duct, so that there is less risk of leaving behind a bridge some small suppurating ethmoidal cell, and it does not leave any scar running along the side of the nose, while the central scar down the middle line of the nose always heals by first intention and leaves no mark. Although Killian formerly tried splitting aside the nasal bones after making a central incision, he abandoned this method, as

it gave a poor access to the region involved, and it was difficult to keep the nasal bone in good apposition during the process of healing. Another advantage of gaining a more median access to the ethmoid cells is that one can the more readily see the exact position of the cribriform plate, and so avoid it, while there is no need to disturb the attachment of the superior oblique muscle, and the direct line of access to the ethmoidal cells allows the operator to see more clearly what is before him, and thus avoid opening into an abnormally placed optic canal in a posterior ethmoidal cell or sphenoidal sinus. For

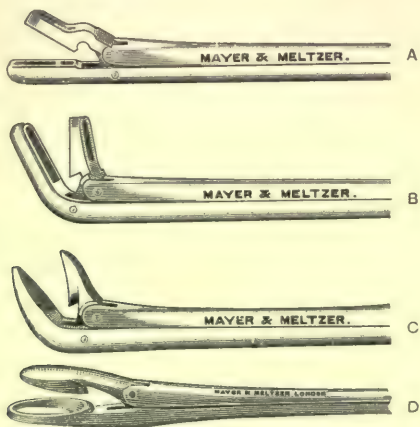


Fig. 132.—Various useful forms of ethmoidal cutting forceps.

A AND B.—Grunwald's.

C.—The author's forceps, with pointed extremities, which readily pierce the softened and diseased bony structures.

D.—Hartmann-Killian.

these reasons I find this osteoplastic method offers advantages over that of Killian, but with deep sinuses special precautions to avoid supra-orbital depression may be necessary, as in Killian's operation.

Treatment of Ethmoidal Cell Suppuration.—The operative treatment of ethmoidal cell suppuration in connection with radical frontal sinus operations is described in the section on frontal sinus operations. But even when frontal sinus suppuration is known to exist, operative removal of ethmoidal cells alone may be undertaken to provide free drainage from the frontal sinus. When the ethmoidal cells, alone, or in association with sphenoidal sinus or maxillary

sinus suppuration, call for interference, intranasal operations are necessary.

In all cases the first step is to remove any polypi and granulation tissue, and to cauterize œdematous mucous membrane in the middle meatus.

When the anterior group is the seat of the disease, the anterior half of the middle turbinal should be removed by an incision with scissors as close to its origin as possible and subsequent snaring, or removal by clipping away the softened bone and diseased tissues with the cutting forceps (see *Fig. 132*). Then with the cutting forceps the bulla ethmoidalis should be opened, and very cautiously the lower portion or floors of the cells above the middle group should be excised and freely opened. To do this may require several sittings, as it is rather a dangerous region to operate on when the parts are obscured by hæmorrhage. The use of suprarenal capsule extract, combined with cocaine, has the advantage of controlling hæmorrhage and rendering the parts anæsthetic.

When the upper and deeper cells have to be opened, a general anæsthetic has advantages, for the operation can be performed leisurely, giving plenty of time for the arrest of hæmorrhage from time to time, so that the parts are well in view. I never like to use curettes, preferring small cutting forceps to nibble away the cell walls. The cribriform plate is in the mid-line, and therefore the operation field should be well outside the mid-line, i.e., outside the vertical plate of the middle turbinate. The posterior cells may be attacked by cutting through the base of the middle turbinate, but great caution must be used in opening the posterior ethmoid cells, especially in their upward extension, for the possibility of an optic nerve canal traversing these cavities must never be lost sight of. Blindness has followed operations in these regions, probably due to the use of a curette and injury to the optic canal and nerve.

In a few cases it is necessary to give a general anæsthetic, but for intranasal operations on the lower ethmoidal cells, nitrous oxide has certain advantages in that the position of the patient allows excellent illumination, while the anæsthesia may be sufficiently prolonged to enable one to do as much as desired at one sitting, without it being followed by the disagreeable symptoms that attend chloroform anæsthesia.

Daily spraying with peroxide of hydrogen, which ferrets out the pus, is of the greatest service in cleansing the area of operation. Unless

the hæmorrhage renders plugging of the passages imperative, it is better to use no plug: firstly, because it may not reach the bleeding spot, and the blood and pus are then liable to be forced into the orbit if any opening or cracking of the os planum has occurred; and secondly, because it so frequently causes just as much bleeding when the plug is removed the next day.

Above all, one must be careful to leave no plugging in the upper recesses of the nasal cavity by accident, as it may be very difficult to recognize its presence when the nasal secretions cover it in the process of healing. Such accidents occur with greater ease than is generally supposed, and may prove disastrous.

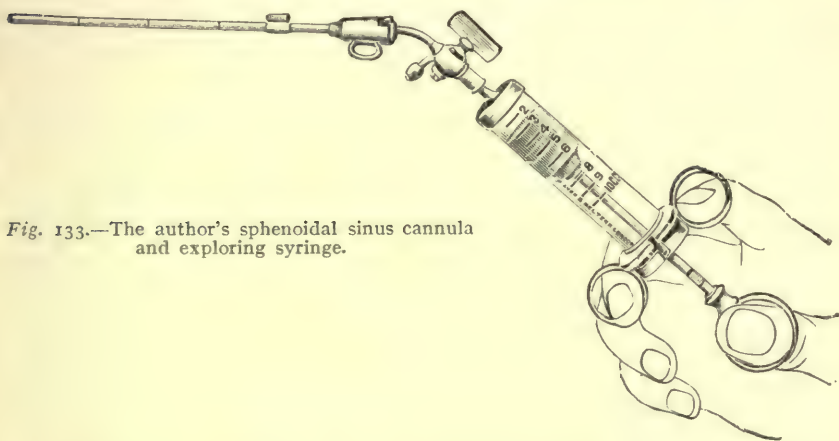


Fig. 133.—The author's sphenoidal sinus cannula and exploring syringe.

External Operations.—The fronto-ethmoidal cells are usually implicated in frontal sinus empyema, and even when the diagnosis, as is often the case, fails to distinguish between the two, they may be attacked by the Ogston-Luc operation, which has already been described. Entry through the inferior wall of the frontal sinus is often to be preferred, as it gives better opportunities of dealing with both the anterior and posterior ethmoidal cells. By turning forward or resecting sub-periosteally a portion of the lacrymal bone, the ethmoidal cells here are laid bare.

When the uppermost and posterior ethmoidal cells are involved, it may be easier and safer to remove them by external operation, then I prefer getting free exposure by an osteoplastic operation, such as

that described on p. 113. This gives the same access to the ethmoid cells and sphenoidal sinus as in the radical frontal sinus operation figured on p. 234. This external operation generally leaves no scar or facial defect whatever.

Others prefer gaining access to the nasal cavity by splitting the nose and turning the parts aside, or by some operation such as Gussenbauer's and Ollier's, Furneaux Jordan's, etc.

The posterior ethmoidal cells and the sphenoidal sinuses, I have found, generally vary inversely in their degree of development—when the one is large, the others are small, and *vice versa*; the amount of pus discharged is therefore no guide to the location of its source.

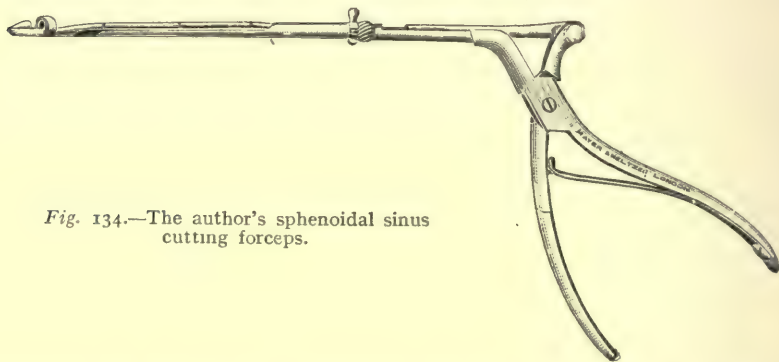


Fig. 134.—The author's sphenoidal sinus cutting forceps.

Ethmoidal cell disease can often only be excluded by the effect of treatment of the sphenoid sinuses.

Treatment of Sphenoidal Sinus Suppuration.—The only effectual treatment is to irrigate and drain the sphenoidal sinus, and although it is a somewhat delicate procedure, it is by no means so difficult as it would at first sight appear.

The posterior group of sinuses, viz., the sphenoidal sinus and the posterior ethmoid cells, offer much difficulty in differential diagnosis, these cavities and their openings into the nose being so close together in the spheno-ethmoidal fissure, far back and high up in the nasal passage, while very often they are all implicated together.

The best plan is to determine first the condition of the sphenoidal sinus, for if either it or the ethmoidal cells contain pus, and the sphenoidal sinus can be excluded, it follows that the ethmoidal cells alone are diseased.

In some few cases it is possible to see the sphenoidal sinus opening through the nasal passage, and then pus may be seen pouring out of the opening, and fresh pus re-appearing as soon as it is wiped away. In a large number a fine cannula can be passed through the opening and the sinus washed out, particularly with the aid of Killian's method of median rhinoscopy or if the middle turbinal be partially ablated. But, apart from the fact that in most patients such partial turbinectomy is essential before entrance through the natural opening is possible, and thus, in the event of a healthy sinus being found, an unnecessary operation on the turbinated body is performed, it is not

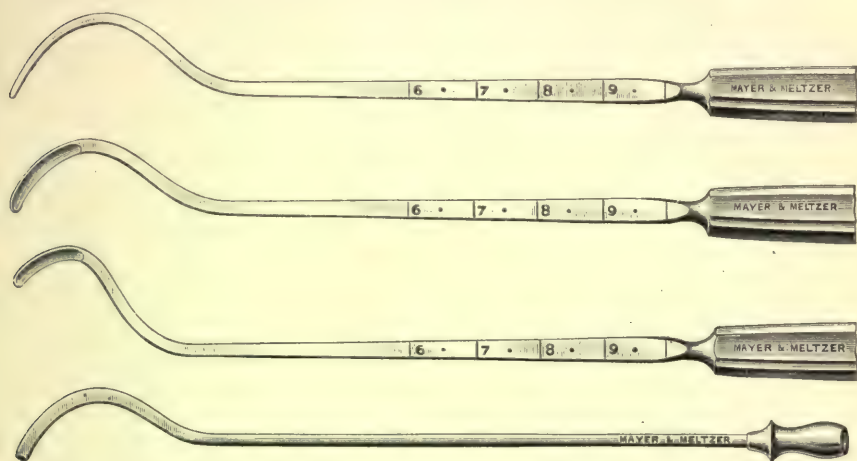


Fig. 135.—Andrews' probe, cannula and knives.

easy to be sure that the fluid escaping from the nose has not become contaminated with mucopus after its exit from the sphenoidal sinus.

On account of these difficulties and sources of error, I have devised a plan by which the existence of pus in a sphenoidal sinus can be determined with comparative ease and certainty, and I think, providing due care and skill are used, with safety. Under either local or general anæsthesia, the patient lying on the back, the fairly fine cannula, with a blunt trocar, is passed through the thin anterior wall of the sinus in the following manner:—

The blunt trocar and cannula is passed along the floor of the nose till it impinges against the posterior pharyngeal wall; then the distal

end is carried forward along the roof of the nasopharynx till it slips up the anterior wall. In this way one gets the point about a quarter of an inch above the lower border of the anterior wall of the sphenoidal sinus. Holding the cannula as nearly horizontal as feasible, it is gently but firmly pressed against the thin anterior wall, which it readily enters. The cannula is then removed and the syringe attached. The contents of the sinus are then aspirated, or some boracic acid solution is thrown in, and sucked up into the syringe.

If pus is present, and the sinus has to be freely opened, this is done by introducing blunt-pointed cutting forceps in much the same way, the exact distance of the anterior sphenoidal sinus wall and the depth

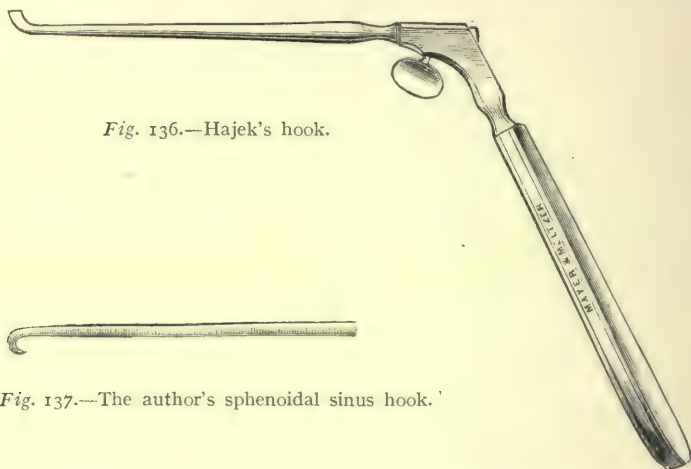


Fig. 136.—Hajek's hook.

Fig. 137.—The author's sphenoidal sinus hook.

of the sinus itself having been already measured by the syringe cannula. As the forceps cuts it is rotated, and in this way the sinus can be opened with comparative ease and safety, as it is only the posterior wall that has to bear the pressure of the blunt end of either syringe or forceps, and this wall is nearly always thick and strong.

It is easy to wash out the sinus, if it does contain pus and the anterior wall has been opened, and then if pus still quickly reappears in the region of the spheno-ethmoidal fissure it is certain that it comes from the posterior ethmoidal cells.

Andrews' cannulae are curved at the end so that they can be introduced through the ostium without preliminary removal of the anterior end of the turbinal; the author's cannula pierces the anterior wall.

THE AUTHOR'S SPHENOIDAL SINUS CANNULA AND FORCEPS.



Fig. A.—The author's sphenoidal sinus-exploring cannula *in situ*.

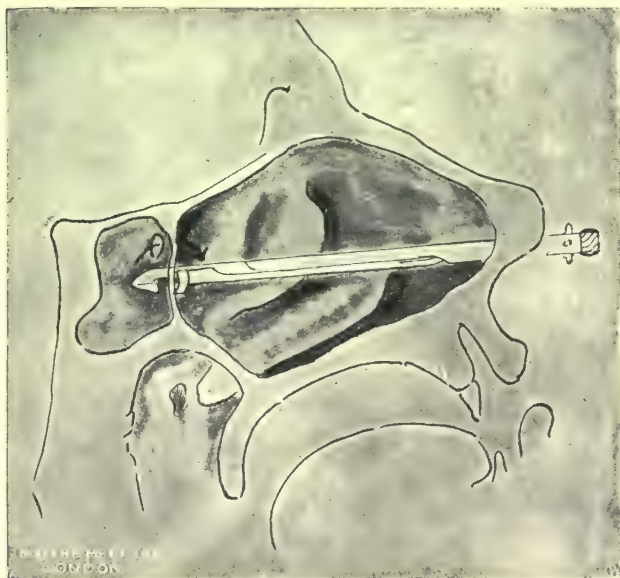


Fig. B.—The author's sphenoidal sinus-cutting forceps *in situ*.

Other instruments may be commended for the free opening of the sinus, such as the author's or Hajek's hook, Lack's cutting forceps, etc. The disadvantage of most instruments is that, unlike my cutting forceps, they cannot be used until the middle turbinal has been partially ablated, on account of their size.

In order to get a free opening in the sinus, Hajek advocates the removal of the posterior ethmoid cells on the affected side, and in many cases this is very desirable, though not always necessary however. The difficulty is, not to make an opening in the anterior wall, but to prevent its more or less rapid closure, hence the advantage of the large opening that Hajek's method presents.

Even after free removal of the anterior wall, there is a great tendency for cicatrization to occur, so that the removed wall may seem to have been replaced by a new one in which a minute opening may be seen.

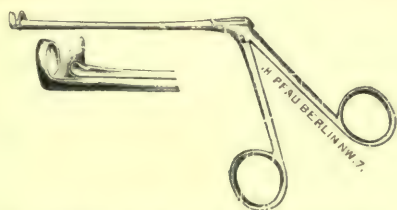


Fig. 138.—The author's small up-cutting sphenoidal sinus forceps for removing remains of the anterior wall. Down-cutting forceps are also used.

This difficulty is diminished if, in addition to the anterior wall, the anterior portion of the floor of the sinus is removed and also the thick lower bony border of the anterior wall near its junction with the floor.

The opening having been established, irrigations are made daily with some mild alkaline or antiseptic solution previously warmed.

With free drainage established, the sphenoidal sinus disease usually improves rapidly. But in some patients free irrigation and drainage fail to cure, owing to the polypoid degeneration of the lining mucosa. It is then necessary to curette with gentleness and great caution the floor and posterior wall, bearing in mind the risks that attend such a procedure. Gently swabbing the sinus walls with a solution of nitrate of silver, 10 to 40 gr. to the fluid ounce, may be used advantageously in chronic intractable cases.

The dangers to be avoided in puncturing the cavity are perforation

of the thin walls of the sinus. Injury to the internal branch of the spheno-palatine artery (see page 12) might cause troublesome hæmorrhage, but this can be controlled by tampons. A consideration of the anatomical relations of the sinus will suffice to demonstrate the dangers of surgical interference unless most cautiously performed, for apart from the great variations in the size and development of the cavities and the thickness or thinness of the walls, there are often present the added dangers of softening of the thin walls due to the disease. Hence no one who is unaccustomed to deal with nasal affections would be justified in attempting these procedures, and every expert rhinologist would observe the utmost caution in their performance.

SECTION XIV.

*MUCOCELES OR BONE CYSTS IN THE NASAL
ACCESSORY SINUSES.*

ETIOLOGY and Pathology.—Mucocèles or bone cysts are fairly common in the ethmoidal labyrinth, especially in connection with the middle turbinated bone, but similar distention of the frontal sinuses and maxillary antra are met with. Probably their relative frequency in the ethmoidal cells is due to several causes: the greater secreting activity and richer glandular supply of the lining mucosa, as compared with that of the frontal sinuses and maxillary antra, their much smaller apertures of exit, and, perhaps above all, their more direct exposure and liability to catarrhal inflammation. Ethmoidal mucocèles are due to progressive distention of one or more cells from the pressure of retained secretion, owing to more or less complete and prolonged obstruction of their apertures or ostia. Probably frontal sinus mucocèles are originated in this manner. But with the antrum of Highmore the pathology of cystic distention is more open to question, and it is very doubtful whether closed antral mucocèle ever arises from simple accumulation of the secretion and distention of its walls, a condition formerly described as “hydrops antri,” “hydrops inflammatorius,” or “dropsy of the antrum.” Logan Turner, in his contribution to the pathology of bone cysts, states that “there is no doubt that many cases have been described as cystic distention of the antrum in which the true nature of the case, namely, the encroachment into the antrum of a cyst of dental origin, has not been recognized. Killian appears to accept the occurrence of true distention of the antrum. . . . Zückerkandl has dealt with this question, and considers that distention of the antrum from an accumulation of serous fluid is outside the range of discussion. . . . Clinical experience goes to show that it is in the region of the canine fossa or facial wall that expansion most frequently takes place” (that is, the strongest, not the weakest walls the cavity), “thus affording further proof of the dental origin of the

cyst in these cases." There is little room for doubting that cystic expansion of the antral walls is almost invariably due to the growth of cysts arising in connection with the teeth. (See *Plates XXXVII and XXXVIII.*)

In rare instances of enlargement of turbinal cells or a frontal sinus, constituting clinically a bone cyst, the cavity contains nothing but air. Such cysts are either mucocèles from which the fluid contents have escaped, or are examples of over-development of otherwise normal cavities.

Bone cysts of the accessory cavities may be classified into three varieties according to their contents: (1) The smaller number, in which the cavity contains nothing but air; (2) The largest number, which contain mucin or clear serous fluid, very frequently with cholesterol crystals; and (3) Those which have mucopurulent or purulent contents, these latter being probably instances where the mucous contents have become invaded by pyogenic organisms.

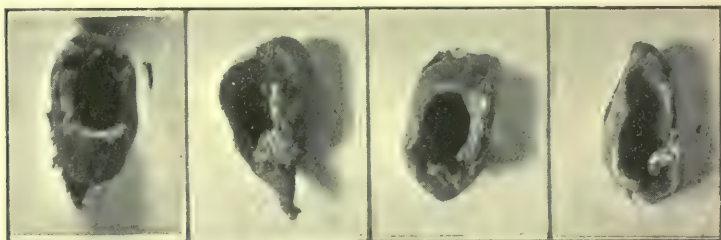


Fig. 139.—Examples of anterior ethmoidal cells at the anterior extremities of middle turbinals, showing the formation of large bone cysts (Walker Downie).

Bony Cysts of the Middle Turbinate.—Bone cells normally exist in the middle turbinate about once in every four or five persons; and when one or more such cells are abnormally developed nasal symptoms may arise. The normal turbinate cell may become distended with secretion from occlusion of the ostium, originating a true mucocèle, and occasionally the contents become purulent from secondary infection. (See *Plate XXVIII.*)

Symptoms.—The most usual symptom is progressive nasal obstruction, and on examination the nasal passage is more or less completely occluded by a tumour extending forwards and downwards from the region of the anterior end of the middle turbinal. As it develops it often pushes the septum over to the opposite side, thus aggravating

the nasal obstruction. To the usual and obvious symptoms of nasal obstruction other symptoms may be superadded, such as dull, boring, or neuralgic pains, very often referred to the supra-orbital region, more rarely to the eye, when lacrymation and photophobia may be present. With increasing size of the cyst the nose may become broadened externally, especially on the involved side. Very large cysts may arise here. Fränkel records one measuring $2\frac{3}{4}$ in. in length, and one is described by Stieda as being as large as a hen's egg. The outer covering of mucous membrane distinguishes the smooth-walled red



Fig. 140.—Transverse section of the nose, showing a large cell-bone cyst of the middle turbinal (Roe).

swelling from a mucous polypus, and when touched with a probe it is resistant and immobile. The conditions from which the diagnosis has to be made are mucous polypus, septal deflection, osteoma, and, when external deformity and pain are present, malignant disease. The treatment consists in removal by cutting forceps.

Mucocele of other Ethmoidal Cells.—The bulla ethmoidalis is sometimes the seat of a mucocele, the symptoms of treatment being similar to that of middle turbinate cysts. But when the enlarged

cavities project into the orbital cavity, the most striking symptoms are those due to displacement of the eye, which is at first a forward displacement, and when the cysts further enlarge, the eye is displaced forwards, downwards, and outwards. There may be nothing abnormal in the appearance of the nasal passages, but the slow, progressive, painless formation of the bony tumour is very characteristic. The majority of recorded cases were in adolescents and young adults, the age and the very slow and painless development of the tumour distinguishing this condition from malignant growth.

Treatment consists in sub-periosteal opening of the cyst, removal of the contents and of the lining wall, and clipping away the projecting portion of the bony cyst wall. It is usually better to make a free opening into the nasal passage to secure perfect drainage and to lessen the risk of recurrence.

Frontal Sinus Mucocoele. (See *Plate XLVI.*)

Symptoms.—The only constant symptom is a very slowly progressive tumour, which appears usually at the upper internal orbital angle, and causes displacement of the eye, usually downwards and outwards. But with the increasing distention of the cavity the bony walls become thinned or absorbed, a process which may occur in any part, including the posterior wall, with perforation of the cranial cavity. As the distended wall becomes thinned, the hard and resistant swelling becomes softer, crackling or fluctuating on palpation.

The conditions from which frontal sinus mucocoele requires to be differentiated are frontal sinus suppuration, exostosis, malignant growths, syphilitic diseases, and osteitis deformans.

Treatment consists in opening the cavity by an incision along the lower border of the eyebrow, evacuation of the contents, removal of the remaining projecting portions of the anterior cyst wall, free opening into the nose, and subsequent intranasal drainage. Sometimes, especially with the smaller cavities, it is better to obliterate the cavity, the lining membrane being completely removed, but without making any communication into the nasal cavity.

Maxillary Antrum Mucocoeles.—As already stated, cystic distention of the maxillary antrum is usually due to the development of dental cysts upwards and into the antral cavity, which becomes distended in the region of the canine fossa or facial wall. This, becoming thinned as it expands, causes a rounded swelling under the cheek, which often presents the so-called "egg-shell crackling" when palpated or pressed upon.

Pain is seldom caused by dental cysts; they, however, cause deformity on the anterior wall of the antrum, when they have developed sufficiently, but the hard palate is not pressed downwards, at any rate unless the cyst has grown up into the antral cavity.

The diagnosis sometimes presents difficulties from the resemblance to the external deformity of the cheek in epithelioma or sarcoma of the superior maxillary bone. In malignant growths, however, pain is an early and marked symptom, and such growths may produce, not only swelling of the cheek, but depression of the hard palate, while epiphora from invasion of the tear-duct is not uncommon.

Malignant disease of the antrum often causes suppuration, so that the symptoms of antral suppuration may be associated with those due to the neoplasm. On transillumination the antrum is opaque, or nearly so, from malignant disease, but a cystic antrum is more or less clear.

The **Treatment** of antral mucocoele is the same, or practically the same, as the operative treatment for chronic suppuration through the canine fossa, the antral cavity being cleared of all the cyst wall and a large counter-opening made into the inferior meatus.

MIXTURE.

4. R.—Liquid Extract of	Myrtus Chekan	20 ℥	1·18 mls.
"	Yerba Santa	20 ℥	1·18 mls.
"	Grindelia Robusta	20 ℥	1·18 mls.
"	Quebracho	1 fl. dr.	3·55 mls.
Brandy		2 fl. dr.	7·10 mls.

For spasmodic asthma, to be taken with half a tumblerful (142·06 mls.) of hot water.

INSUFFLATIONS.

Nasal.

5. R.—Bismuth Oxychloride	$\frac{1}{4}$ gr.	·0162 gramme
Morphine Acetate	$\frac{1}{32}$ gr.	·002 gramme
Starch	$\frac{1}{4}$ gr.	0·162 gramme

Make one powder for insufflation.

Ferrier's Snuff.

6. R.—Morphine Hydrochloride	2 grs.	·13 gramme
Pow. Gum. Acacia	2 drs.	7·776 grammes
Bismuth Subnitrate	6 drs.	23·33 grammes

A small pinch to be insufflated at a time.

7. R.—Salicylic Acid (powd.)	10 grs.	·648 gramme
Tannic Acid (powd.)	60 grs.	3·887 grammes
Bismuth Subcarbonate	60 grs.	3·887 grammes

For nasal catarrh (Lefferts, New York).

8. R.—Menthol	10 grs.	·648 gramme
Powdered Gum Acacia	20 grs.	1·295 grammes
Iodol in fine powder	100 grs.	6·48 grammes
Boric Acid powder	200 grs.	12·96 grammes
White Sugar to	1 oz.	31·104 grammes

Menthol Snuff.

9. R.—Menthol	1 part	1 gramme
Boric Acid (powd.)	2 parts	2 grammes
Ammonium Chloride (powd.)	3 parts	3 grammes
Cocaine Hydrochloride	$\frac{1}{100}$ part	·01 gramme

Sedative and antiseptic.

10. R.—Borax (powder)	10 grs.	·648 gramme
Sodium Chloride	20 grs.	1·295 grammes
Ammonium Chloride	10 grs.	·648 grammes
Camphor	1 gr.	·0648 grammes

Mildly stimulating in chronic rhinitis.

- | | | |
|--|---------|---------------|
| 11. R.—Citric Acid | 60 grs. | 3·888 grammes |
| Sugar of Milk | 30 grs. | 1·944 grammes |
| Powdered Gum Acacia | 30 grs. | 1·944 grammes |
| Stimulating in atrophic rhinitis. | | |
| 12. R.—Orthoform | 60 grs. | 3·888 grammes |
| Starch | 20 grs. | 1·296 grammes |
| Cocaine Hydrochloride | 10 grs. | ·648 gramme |
| Powdered Gum Acacia | 30 grs. | 1·944 grammes |
| Sedative and antiseptic in malignant ulceration. | | |

SYRUPS.

Compound Syrup of Camphor (Bristol Royal Infr. Phar.).

- | | | |
|---|------------------|------------------|
| 13. R.—Camphor | 120 grs. | 7·775 grammes |
| Oil of Anise | 2 fl. drs. | 7·10 mils. |
| Benzoic Acid | 180 grs. | 11·663 grammes |
| Glacial Acetic Acid | 7 fl. oz. | 198·886 mils. |
| Tincture of Opium | 11 fl. oz. | 312·535 mils. |
| Squills | 5 oz. | 155·517 mils. |
| Ipecacuanha | 2 oz. | 62·207 mils. |
| Purified Sugar | 28 lbs. | 12·7 kilogrammes |
| Burnt Sugar | enough to colour | q.s. |
| Distilled Water | to 4 gallons | 18·184 litres |
| One teaspoonful to be taken occasionally. | | |
| (Approximately, ℥j (·089 mil.) tincture of opium in 1 fl. dr. (3·55 mils).) | | |

PAINTS.

- | | | |
|---------------------|-------------|------------------|
| 14. R.—Protargol | 5 to 7 grs. | ·324–·594 gramme |
| Glycerin | 1 fl. dr. | 3·55 mils. |
| Distilled Water | 1 fl. dr. | 3·55 mils. |
| Antiseptic. | | |
| 15. R.—Chromic Acid | 45 grs. | 2·916 grammes |
| Distilled Water | 1 fl. oz. | 28·412 mils. |

For application to ulcerated surfaces by means of a finely-pointed cotton-wool brush. To be followed quickly by an alkaline wash (Cent. Lond. Thr. Hosp.).

Pigments may be applied by means of a brush or by a cotton-wool carrier. The latter is more cleanly, clean cotton-wool being used each time. The carrier should be wetted, and applied to one end of a shred of cotton-wool, and then rotated in one direction until the whole shred of wool is firmly wound round it. The wool is then dipped in the solution and applied locally.

16. R.—Dry Suprarenal Capsule (powd.) 30 grs. 1·944 gramme
 Triturate for 5 minutes with $2\frac{1}{2}$ fl. drs. (8·879 mils.) of chloroform water, filter through paper by aid of a pump.
 Pass 15 ℥ chloroform water (or q.s. to make $2\frac{1}{2}$ fl. drs. = 8·879 mils.) through the marc.
 To filtrate: add glycerin $1\frac{1}{2}$ fl. dr. (5·327 mils.) and mix. (Approximately 10 % solution.)
 The use of suprarenal extract is liable to be followed by secondary hæmorrhage from cut vessels.
17. R.—Papain 4 grs. ·259 gramme
 Lactic Acid 4 ℥ ·237 mil.
 Distilled Water to 1 fl. oz. 28·412 mil.
18. R.—Silver Nitrate 10 to 60 grs. ·648 to 3·888 grams.
 Distilled Water 1 fl. oz. 28·412 mils.
- The previous application of a 10 % solution of cocaine nitrate, which does not precipitate the silver solution, renders the application painless.



Fig. 141.—The "Aqual" pocket atomiser.

FOR USE WITH THE OIL ATOMISER.

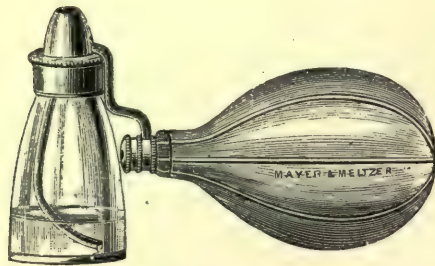


Fig. 142.—The oil atomiser.

19. R.—Eucalyptol 10 ℥ ·592 mil.
 Terebene 10 ℥ ·592 mil.
 Liquid Paraffin 1 fl. oz. 28·412 mils.
 Antiseptic.
20. R.—Cocaine 5 grs. ·324 gramme
 Menthol 15 grs. ·972 gramme
 Terebene 10 ℥ ·592 mil.
 Liquid Paraffin 1 fl. oz. 28·412 mils.
 Sedative.

- | | | |
|----------------------------------|-----------|---------------|
| 21. R.—Eucalyptol | 20 ℥ | 1·184 mls. |
| Camphor | 2 grs. | ·130 gramme |
| Oil of Pine | 8 ℥ | ·474 mls. |
| Liquid Paraffin | 1 fl. oz. | 28·412 mls. |
| Stimulating in chronic rhinitis. | | |
| 22. R.—Eucalyptol | 20 ℥ | 1·184 mls. |
| Aristol | 10 grs. | ·648 gramme |
| Menthol | 20 grs. | 1·296 grammes |
| Liquid Paraffin | 1 fl. oz. | 28·412 mls. |
| In fœtid rhinitis. | | |
| 23. R.—Eucalyptol | 20 ℥ | 1·184 mls. |
| Menthol | 10 grs. | ·648 gramme |
| Terebene | 10 ℥ | ·592 mls. |
| Cocaine | 6 grs. | ·389 gramme |
| Liquid Paraffin | 1 fl. oz. | 28·412 mls. |
| In acute rhinitis. | | |

DOUCHES AND SPRAYS.

- | | | |
|--------------------|-----------|-------------|
| 24. R.—Phenol | 4 grs. | ·259 gramme |
| Sodium Bicarbonate | 15 grs. | ·972 gramme |
| Borax | 10 grs. | ·648 gramme |
| Glycerin | 45 ℥ | 2·664 mls. |
| Distilled Water to | 1 fl. oz. | 28·412 mls. |

To be used with an equal quantity of warm water.

Spray up the nostrils with an atomiser or use with the nasal douche. Mildly detergent, useful in fœtid discharge from the nose, and in hypertrophic rhinitis.

- | | |
|---------------------------|---------------|
| 25. R.—Chloride of Sodium | } equal parts |
| Bicarbonate of Sodium | |
| Borax | |

Mix 1 drachm (3·888 grammes) of the powder to 1 pint (568·25 mls.) of warm water. For nasal douche.

Macfarlane's Nasal Plasma Tablets.

- | | | |
|------------------------|---------|--------------|
| 26. R.—Sodium Chloride | 5½ grs. | ·3564 gramme |
| Sodium Sulphate | 1½ grs. | ·0974 gramme |
| Sodium Phosphate | ¼ gr. | ·0162 gramme |
| Potassium Chloride | ⅝ gr. | ·0424 gramme |
| Potassium Sulphate | ¼ gr. | ·0162 gramme |
| Potassium Phosphate | ⅓ gr. | ·0215 gramme |
| Menthol | ⅓ gr. | ·0021 gramme |

In one tablet. A Macfarlane tablet, dissolved in two ounces of water, makes a useful solution of the same sp. gr. as nasal plasma.

31. R.—Cocaine Hydrochloride	30 grs.	1·944 grammes
Morphine Hydrochloride	10 grs.	·647 gramme
Salicylic Acid	$\frac{1}{2}$ gr.	·0324 gramme
Distilled Water to 1 fl. oz. (=10 % cocaine)		28·412 mils.

Morphine is in some respects a physiological antidote to cocaine, tending to lessen its toxic action.

32.* R.—Cocaine Hydrochloride	60 grs.	3·888 grammes
Morphine Hydrochloride	10 grs.	·647 gramme
Sodium Sulphate	6 grs.	·389 gramme
Distilled Water to 1 fl. oz. (= 20 % cocaine)		28·412 mils.

Local anæsthetic.



Fig. 145.

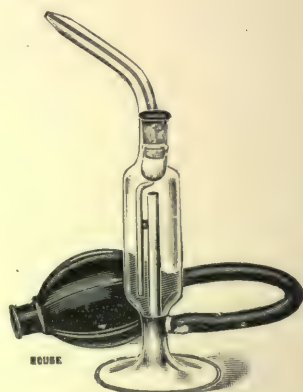


Fig. 146.

Figs. 145, 146.—Two convenient forms of nasal sprays for aqueous solutions, for general use in the consulting room (about one-third full size).

33. R.—Hydrogen Peroxide (20 vol.)	1 fl. oz.	28·412 mils.
Cocaine Hydrochloride	30 grs.	1·944 grammes
Morphine Hydrochloride	10 grs.	·647 gramme

A useful sedative and cleansing spray in tuberculous or malignant ulceration.

34.* R.—Eucaine Hydrochloride	60 grs.	3·888 grammes
Sodium Sulphate	6 grs.	·389 gramme
Distilled Water to	1 fl. oz.	28·412 mils.

Local Anæsthetic.

* The addition of sodium sulphate (2 per cent) in Formulæ 32 and 34 is based on Wyatt Wingrave's investigations, which showed that the neutral sodium salt aided the absorption and effectiveness of the cocaine or eucaine; thus economizing the alkaloid, and, in the case of cocaine, minimizing the risk of constitutional symptoms.

35. R.—Equal parts of Formulæ 16 and 34 when local anæsthesia and ischæmia are desired while avoiding the use of cocaine.

36. R.—Atropin Sulphate	2 grs.	0·15 gramme
Sodium Nitrite	9 grs.	0·60 gramme
Glycerin	20 ℥	2·00 grammes
Distilled Water	$\frac{1}{2}$ fl. oz.	15·00 grammes

Bertram's formula, recommended for Asthma by Treupel,* inhaled in the form of a fine spray.

37. R.—Cocaine Nitrite	1·0 per cent
Atropin Nitrite	0·6 per cent
Glycerin	32·2 per cent
Distilled Water	66·2 per cent

Einhorn's formula, recommended by Treupel* for Asthma, for use in a fine spray or aeriser.

PILLS AND TABLETS.

38. R.—Valerianate of Zinc	1 to 2 grs.	·0648 to ·1296	gramme
Arseniate of Strychnine	$\frac{1}{64}$ to $\frac{1}{32}$ gr.	·001—·002	gramme
Excip. enough to make one pill or tablet			q.s.
39. R.—Valerianate of Zinc	1 to 2 grs.	·0648—·1296	gramme
Heroin Hydrochloride	$\frac{3}{32}$ to $\frac{1}{16}$ gr.	·002—·004	gramme
Arseniate of Strychnine	$\frac{1}{64}$ to $\frac{1}{32}$ gr.	·001—·002	gramme
Excip. enough to make one pill or tablet			q.s.
40. R.—Arseniate of Strychnine	$\frac{1}{64}$ to $\frac{1}{32}$ gr.	·001—·002	gramme
Excip. enough to make one pill or tablet.			q.s.

LOCAL ANÆSTHETICS.

Of the various substitutes for cocaine, stovaine, eucaine, and novocain are now commonly employed in the formulæ given below; any of these may be substituted for cocaine.

Le Brocq, from a comparative investigation of these and other cocaine substitutes, concludes that "novocain is the most satisfactory for general use. Its anæsthetic action is equal to that of cocaine, and its toxicity and general destructive power in the tissues are very much less." Beta-eucaine lactate is nearly equal to cocaine in anæsthetic properties, but is more irritating. The statement of Le Brocq that novocain is equal to cocaine in anæsthetic power is not borne out in my experience; its action is slower, and even in 20 per cent solution its local anæsthetising power is inferior to cocaine, although quite sufficient for general use.

* *Brit. Med. Jour.*, ep. March 13th, 1909, p. 43.

Cocaine salts decompose with boiling, whereas the substitutes mentioned can all be sterilized by boiling without deterioration. On the other hand they are slower in action, and unlike cocaine salts do not produce local ischæmia, for which purpose a little adrenalin solution is added.

Cocaine nitrate is not decomposed by silver nitrate, and is therefore used when local anæsthesia is desired before application of the silver solution.

NOTE ON POST-MORTEM EXAMINATIONS ON THE NOSE AND THE NASAL ACCESSORY SINUSES.

The sphenoidal, posterior ethmoidal, and frontal ethmoidal sinuses may be laid freely open from above by removing, with chisel and forceps, the thin plate of bone forming the sella turcica, olivary process, olfactory groove, and the portion of the orbital plates of the frontal bone in the floor of the anterior cerebral fossa lying just external to the cribriform plate; while the frontal sinus may be laid bare by removing its posterior wall and roof external to the foramen cæcum. The upper part of the nasal fossæ may be inspected by removing the roof formed by the cribriform plate and crista galli. The maxillary antrum may be opened by raising the lip and cheek, incising the gingivo-buccal mucous membrane, then laying bare and opening into the wall of the antrum over the canine fossæ. No facial deformity is involved by these methods of examination.

For a fuller inspection of the *nasal cavities* from in front, the skin and subcutaneous tissues may be reflected from above downwards, as far as the nasal bones, drawing down the anterior half of the scalp after it has been divided as usual in opening the skull. The nasal bones should then be divided, as in Ollier's operation, and the whole nose turned down. After examination is completed the parts should be replaced. Very little disfigurement is left if this be carefully done.

Another method of exposing the nasal fossæ is to perform Rouge's operation on the cadaver; and replacement of the parts leaves even less deformity, although this method does not afford good inspection of the upper parts of the nasal passages.

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*INSTRUCTIONS FOR USING THE AUTHOR'S
ADJUSTABLE STEREOSCOPE.*



TO ILLUSTRATE THE METHOD OF USE.

1. Draw out the movable prism until there is a gap of at least half-an-inch, and holding the stereoscope close to the eyes, look at the picture, which should be about eight inches off. Take care to hold the Stereoscope parallel with the picture, or the figures will not blend clearly.

2. If two separate pictures appear to view, try with the prism drawn out a little further; but if the observer's eyes are rather close together, it may be necessary to close up the gap to a quarter-of-an-inch or less.

3. Having obtained the single stereoscopic picture standing out in relief, note the distance that the lens is drawn out, for future guidance. The nearer the prisms can be brought together without losing the stereoscopic effect, the more comfortable is the use of the instruments.

4. Spectacles for correcting short sight or astigmatism should not be discarded, but long-sight spectacles should be removed while the stereoscope is in use.

5. Once the picture has been properly viewed, no difficulty will be experienced. If the stereoscope is advanced a short distance from the eyes, any lateral images will disappear.

Preparation of a skull. The left malar bone has been sawn off, displaying the left maxillary antrum; the large orifice of communication with the nasal fossa is seen, and the partial subdivision of the cavity below the septa should be noted. The ethmoidal cells have been exposed by removing their outer walls; the extreme thinness of the bony partition dividing these cells from the orbital cavity will be observed.



PLATE XX.—TO SHOW THE MAXILLARY ANTRUM AND THE ETHMOIDAL CELLS

Showing the right sphenoidal and both frontal sinuses, and various structures in the outer wall of the nasal fossa. It is the same preparation as *Plate III*, to which reference may be made for a full description, the purpose of this plate being to give a view of this complicated region in stereoscopic relief.

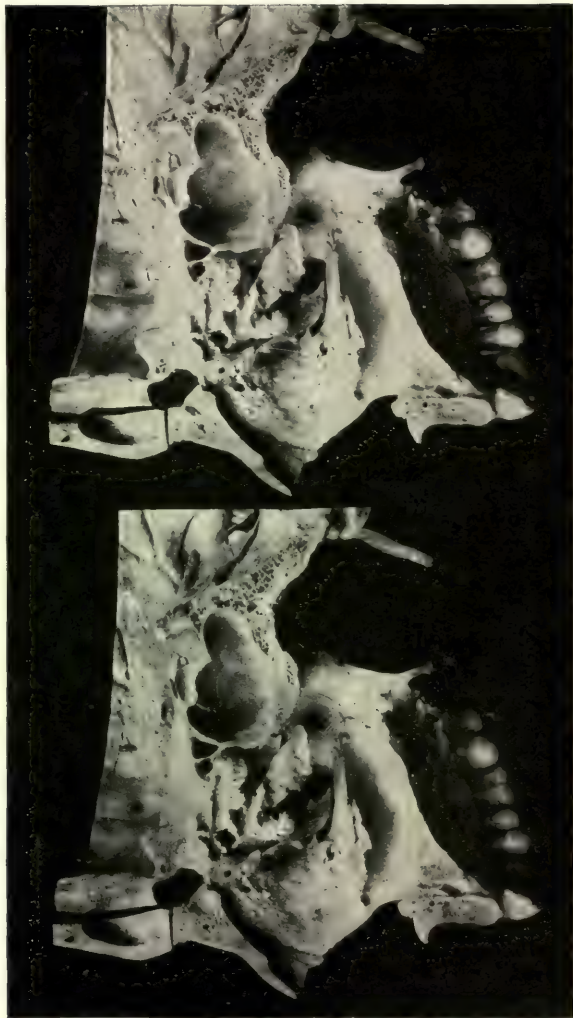
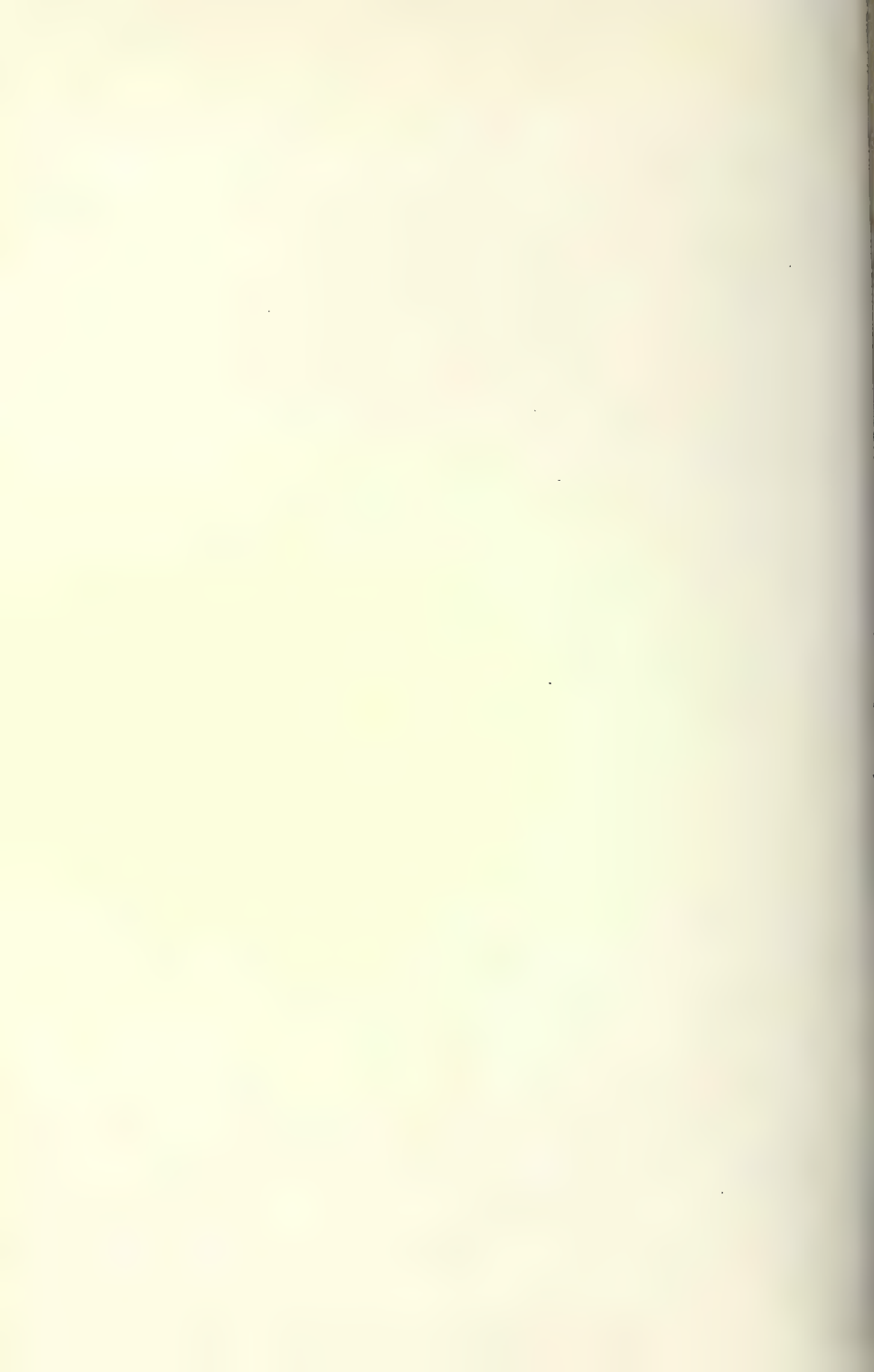


PLATE .XV.—MESIAL SECTION OF THE SKULL

A skull with the frontal sinuses laid open by the removal of the anterior wall.

Note the extension of the sinuses laterally and their depth, running backward above the orbital cavity, the deviation of the median septum, the existence of other incomplete septa in each of the cavities, and on the left side the commencement of the fronto-nasal duct.

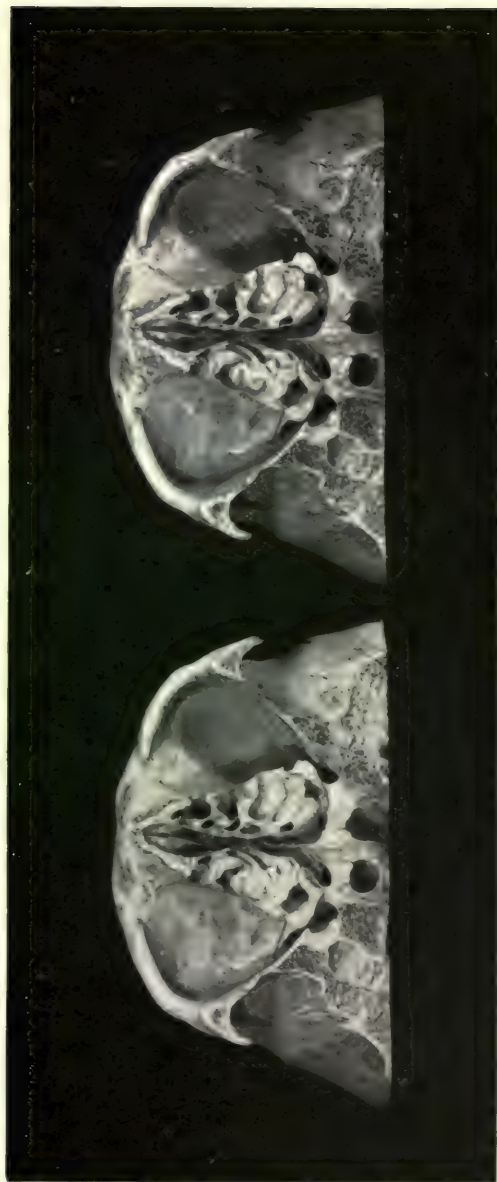




The relationship of the ethmoidal cells and sphenoidal sinuses to the inner orbital walls, etc., and to the outer and posterior aspects of the nasal passages, are clearly displayed.

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A median section of the nose immediately to the right of the nasal septum, which has been removed so as to expose the outer wall of the left nasal passage, and lay open the right frontal sinus. A window has been cut in the middle turbinate body to show a probe in its passage upwards to the left frontal sinus. Another window has been cut in the inferior turbinate body, and a small slit into the nasal duct higher up, so that one may trace the course of the probe which has been passed through the lacrymal sac and down the nasal duct into the nose.

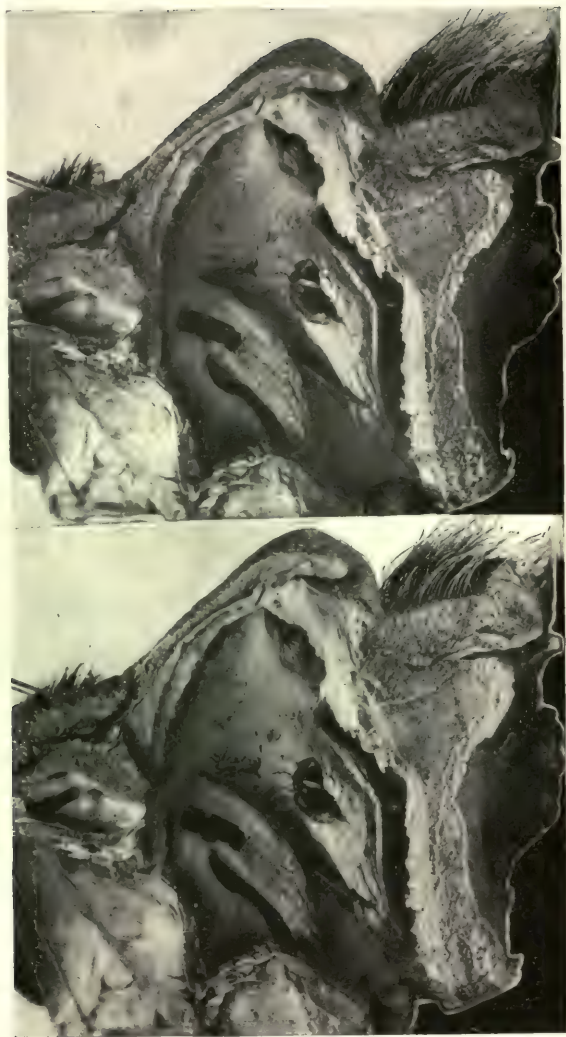
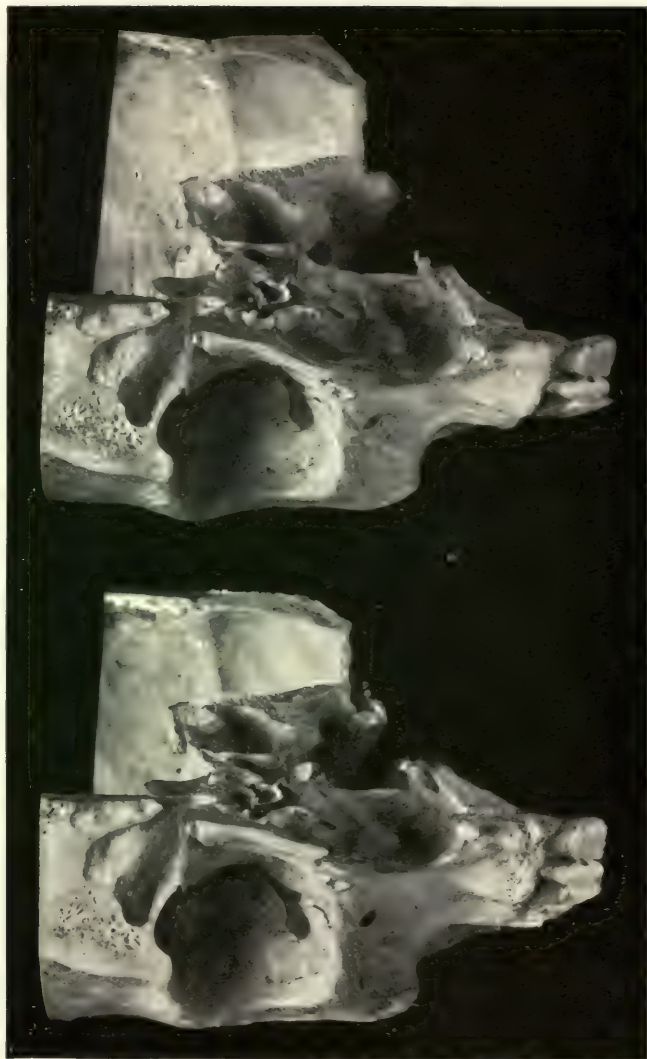


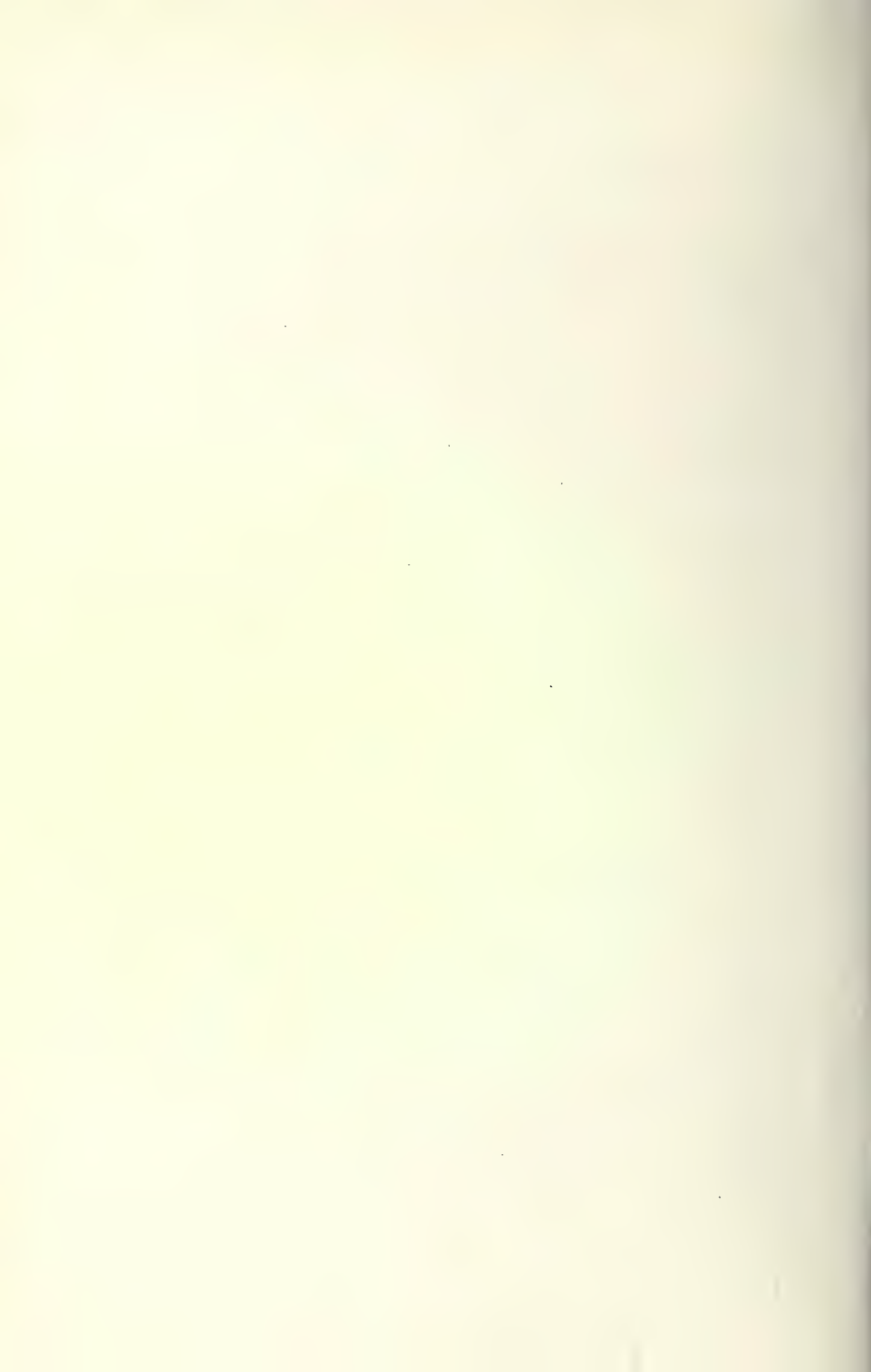
PLATE XVII.—THE OUTER WALL OF THE LEFT NASAL PASSAGE

The same preparation as *Plate XXV*, but viewed from in front, so as to show the relations of the various sinuses and structures in the nose to the orbital cavity, etc., and very much as they would appear in anterior rhinoscopy. Note especially that the cribriform plate is almost as low as the middle of the inner orbital wall, at any rate lower than is sometimes realized.



The same dissection as *Plate XXIV*, but viewed from in front, so as to show the relations of the various structures in the nose to the eye and other parts of the face. Bristles have been placed in the apertures of the sphenoidal sinus and of one of the posterior ethmoidal cells. It will be noted that the ostium maxillare in this specimen is abnormally low, appearing below the border of the middle turbinated body.





Showing the relations of the nasal passages and the posterior ethmoidal cells to the cribriform plate. (1) The orbital cavity, etc.; (2 and 3) the posterior portion of the maxillary antrum, showing a well-marked transverse septum; the upward extension of this part of the antrum is displayed; (4) posterior ethmoidal cells; (5) the nasal septum; (6) the middle turbinate body; (7) the inferior turbinate body.

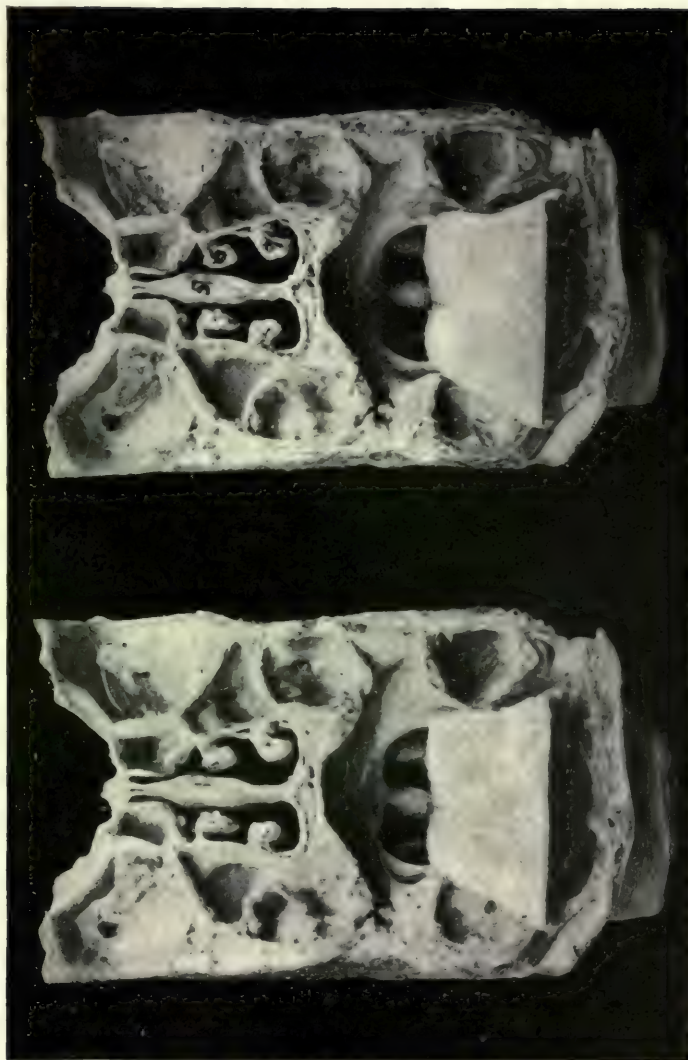


PLATE XVI.—CORONAL SECTION THROUGH THE POSTERIOR PORTION OF THE NOSE

Section looked at from behind, showing the relations of the orbits to the antral cavities, ethmoid cells, and nasal passages. Note especially that on each side the middle turbinal bodies are cystic, i.e., bony cysts (which are in reality aberrant ethmoid cells) have developed, and cause obstruction in the nasal passages. The cribriform plate (and therefore the roof of the nasal passages) is horizontally much lower than the roof of the orbits at this point. ZUCKERKANDL.

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This preparation shows backward orbital extension of the frontal sinus on the left side; while on the right-hand side the frontal sinus has not extended so far back as the line of section. The striking feature in the preparation is the very marked asymmetry of the maxillary antra. On the left side it is small, and extends forwards further than it does on the right side, where the maxillary antrum is well developed. The elevation from the floor of antrum on the right side, produced by the upward extension of the fangs of the bicuspid tooth, is well displayed.

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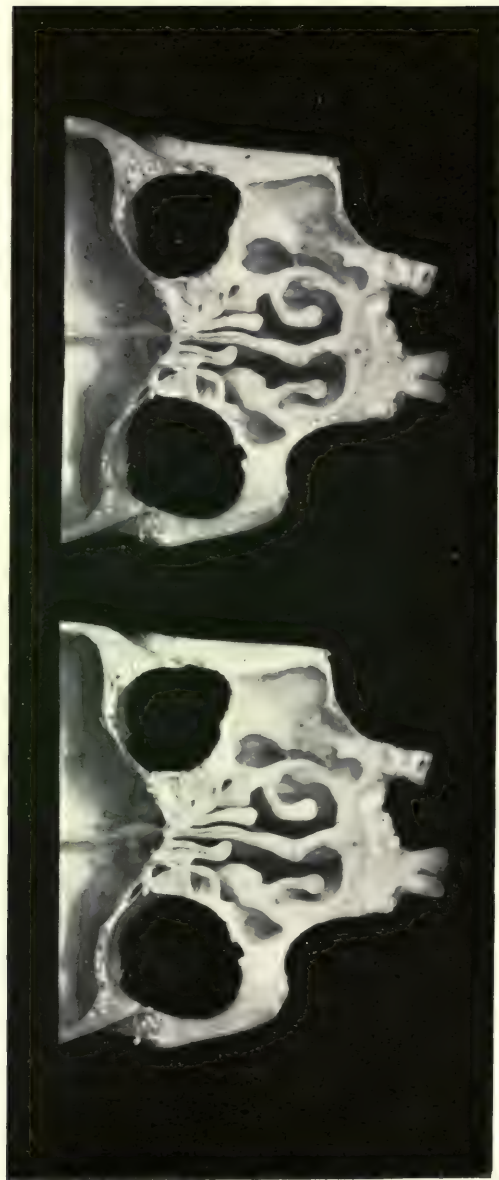


PLATE XXV.—TRANSVERSE SECTION OF THE SKULL POSTERIOR TO CRISTA GALLI.

The anterior walls of the frontal sinus and ethmoidal cells have been removed. On the right a very large and irregular cavity, apparently the left frontal sinus, is really a very large anterior ethmoidal cell, which has been extended forward, occupying the position normally occupied by the frontal sinus; the true frontal sinuses being the two relatively small cells on the left of the middle line of the plate, while further still to the left is seen a small ethmoidal cell, lying to the right-hand or outer side of what is the true right frontal sinus. This well shows how ethmoidal cells may occupy the position normally occupied by the frontal sinus. That the large cavity which looks like the left frontal sinus was truly the ethmoidal cell was proved by the fact that there was no connection with the naso-frontal duct from this cell. The naso-frontal duct extended into the right nasal passages from the two smaller cells, which have already been referred to as right and left true frontal sinuses.

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PLATE XXX.—REMOVAL OF THE ANTERIOR BLADE OF THE FRONTAL BONE OF THE SUPRACRIBAL REGION.

Entering the orbital fossa are the frontal, nasal, and lacrymal branches; the supra-orbital branch of the frontal is ascending on the forehead. The posterior dental branches of the superior maxillary nerve and, at its exit from the infra-orbital foramen, the anterior dental, nasal and labial branches. The pterygoid, the auriculo-temporal, and the inferior dental branches of the inferior maxillary nerve are also displayed.

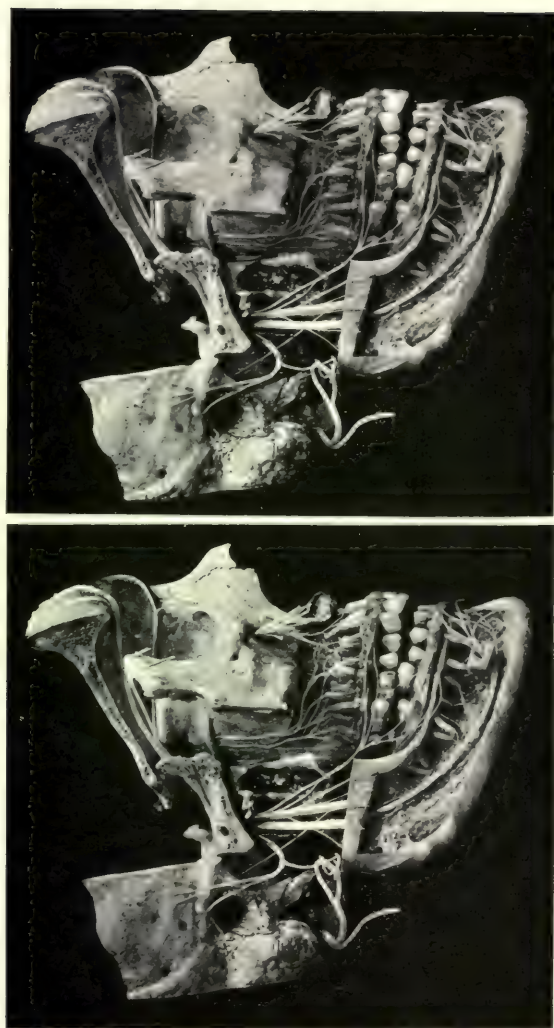
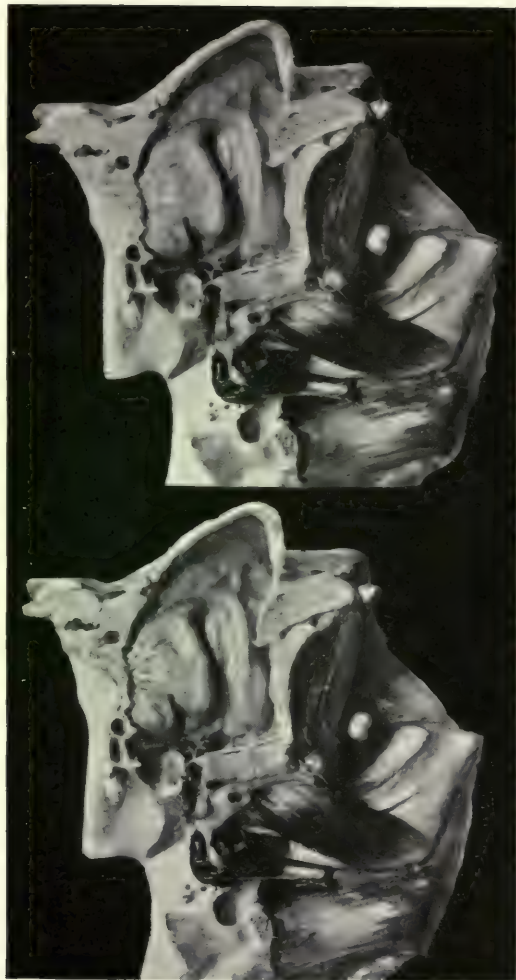
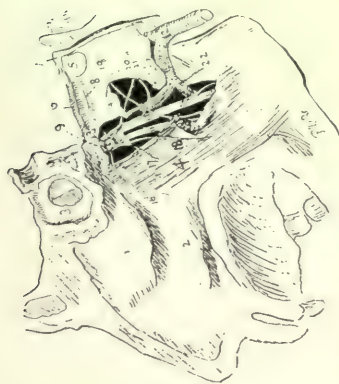


PLATE XXXV.—DISTRIBUTION OF THE FIFTH NERVE. (*Stereoscopic and Semi-diagrammatic.*)

The Eustachian tube and its relations to the nose, to the internal carotid artery and other structures are displayed. Just above the Eustachian tube the bone has been removed to display the twigs from the sympathetic plexus and from the facial, these unite to form the Vidian nerve, which joins Meckel's ganglion. On the outer wall of the left nasal passage the descending filaments of the olfactory nerve are displayed. The small area of the superior turbinate mucous membrane, to which, according to the researches of v. Brunn, these filaments are distributed, is indicated by a dark line. Below the sphenoidal sinus, lying deeply, the sphenopalatine ganglion (Meckel's) appears dimly, but some branches are shown, viz., *descending* to the palate, *posterior* to the pharynx, and *internal* to the nose.

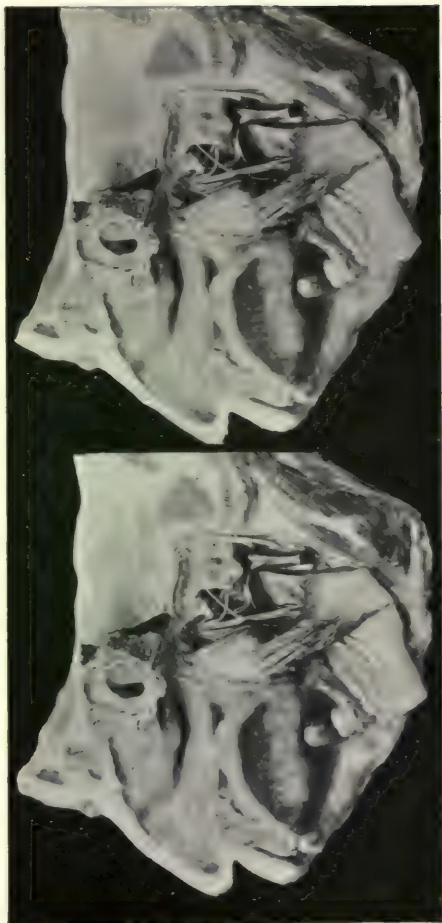
TRAMOND.





Dissection showing the deep view of the right pterygoid region, with the branches of the third division of the fifth nerve, the otic ganglion, the Eustachian tube, the middle ear and its anatomical relations. (1) The middle turbinated body; (2) The inferior turbinated body; (3) The septum between the right and left sphenoidal sinuses; (4) The internal pterygoid muscle; (5) The inner surface of the membrana tympani; (6) Canal for the tensor tympani muscle and its nerve (13); (7) The geniculate ganglion of the facial nerve, which is seen lying in the hiatus Fallopii; (8) Canal for the Eustachian tube, separated from that for the tensor tympani above by the processes cochleariformis; (9) The otic ganglion; (10) Inferior dental nerve; (11) Lingual or gustatory nerve; (12) The external carotid artery dividing into temporal and internal maxillary arteries; (13) Two nerves, viz., above, the small petrosal joining the otic ganglion, and the branch to the tensor tympani muscle below; lower still, twigs from the plexus on (14) the middle meningeal artery form the sympathetic root to the ganglion; (16) Branches to the tensor palati muscle; (17) and (18) Nerve to the internal pterygoid muscle; (19) Chorda tympani; (20 and 21) The auriculo-temporal nerve; (22) Internal maxillary artery, from which ascends its middle meningeal branch.

TRAMOND.



The illustration shows mucous nasal polypi growing from the unciform plate by relatively narrow pedicles; this is the site from which nasal polypi of the middle meatus nearly always arise, and it will be seen that it is easy to remove such polypi by picking them off with forceps from the seat of origin, grasping the pedicles with cutting forceps, much as one would pick a pear from a tree by detaching the stem.

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PLATE XXVII.—LONGITUDINAL SECTION OF THE RIGHT NASAL PASSAGE.

Case of chronic frontal sinus suppuration in which one sees an unusually large fronto-nasal duct, in the course of which mucous polypoid have arisen; it suggests very strongly the connection between suppuration and the occurrence of mucous polypus. But the main point of interest is that the preparation proves that frontal sinus suppuration is associated with, if it does not actually produce, unusual patency of the fronto-nasal duct.

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PLATE XXXV.—SAGITTAL SECTION THROUGH THE RIGHT NASAL PASSAGE.

A mucous polypus has developed in the left sphenoidal sinus ostium, and grown down into the nasal passage.

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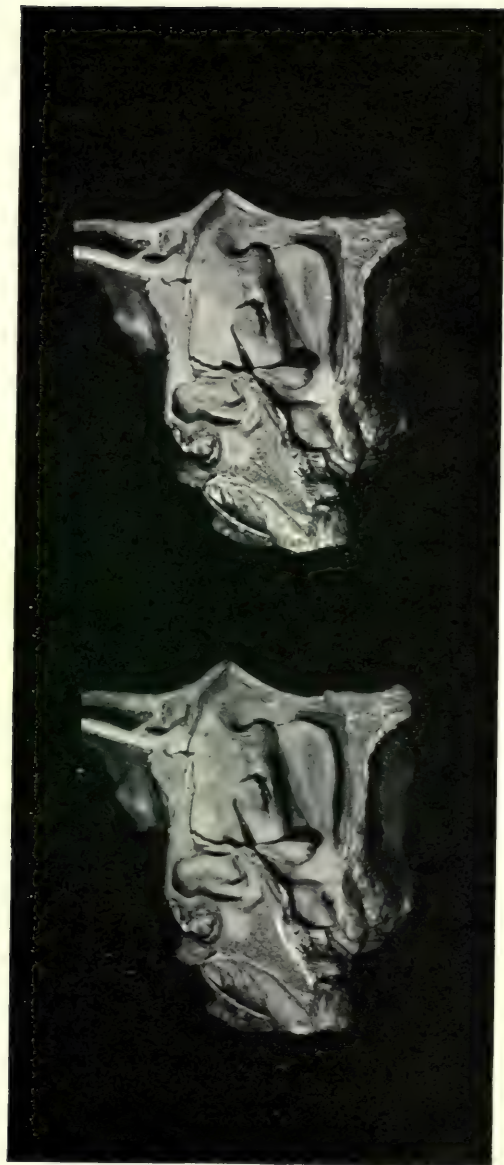


PLATE XXXVI.—LONGITUDINAL SECTION OF THE LEFT NASAL FOSSA.

Both maxillary antra show large cysts in the mucous membrane, that on the left side of the picture largely filling the antral cavity: this is interesting, as it shows that cystic degeneration of the antral mucosa does occur. In the middle meatus of this side is a small nasal mucosa polyp, growing from the ethmoidal bulla, projecting into the nasal passage between the middle and superior turbinats. On this as well as on the opposite side, the uncinate process is seen in section beneath the bulla.

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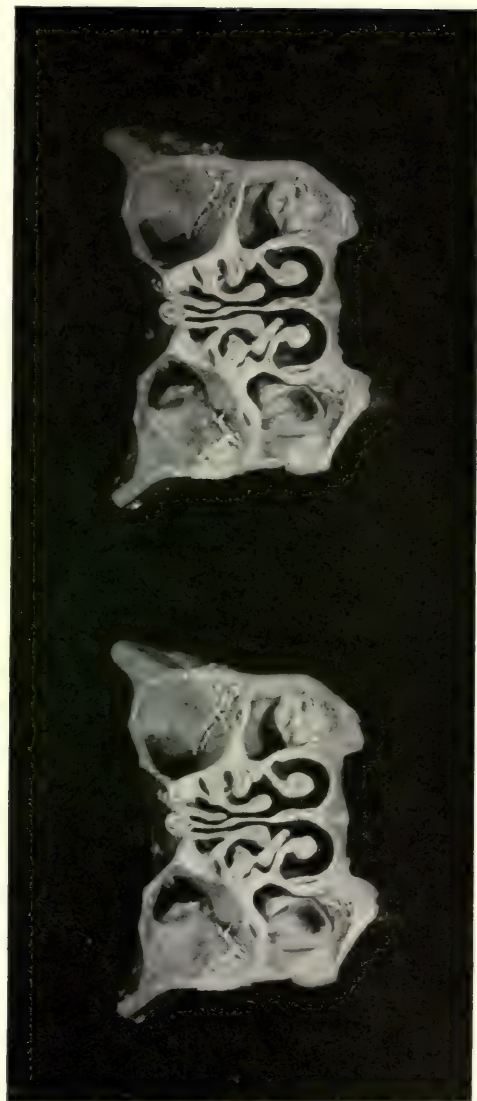


PLATE XXXVII.—TRANSVERSE SECTION THROUGH THE NASAL CAVITIES AND ORBITS.

On either side the orbital fossæ are seen in section, the roof being formed by the anterior fosse and the skull. It will be seen that the frontal sinus extends backwards from the inner half of the orbital roof on either side, so that although the section is made at least two inches from the front of the head, the posterior orbital extensions of the frontal sinuses are seen in section. When frontal sinus suppuration has occurred, necessitating obliteration of the sinus, it will be realized that it is impossible to remove pyogenic mucous membrane from such a narrow, deep, backward extension of such a frontal sinus; and that even if this can be done, it would not be possible to pack such a narrow slit, so as to make it granulate up from the bottom; while, on the other hand, the removal of that portion of the orbital roof would enable the orbital fat to rise up and obliterate the cavity—a procedure on which Killian lays so much stress in his operation. Passing from above backward, another feature to note is the position of the cribriform plate, which is seen on either side of the crista galli. It occupies a very considerably lower plane than the higher ethmoidal cells on the right and left. On the right-hand side the middle turbinate body shows the presence of an ethmoid cell. Ethmoidal cells are found in the middle turbinate bone in about 20 per cent of cases. On the left-hand side, on the outer side of the middle turbinate the bulla ethmoidalis is seen making a rounded projection into the inferior meatus. The main point of interest, however, lies in the antral cavities. The left antral cavity is very much encroached upon by the dental cyst which has extended upwards and into the antrum.

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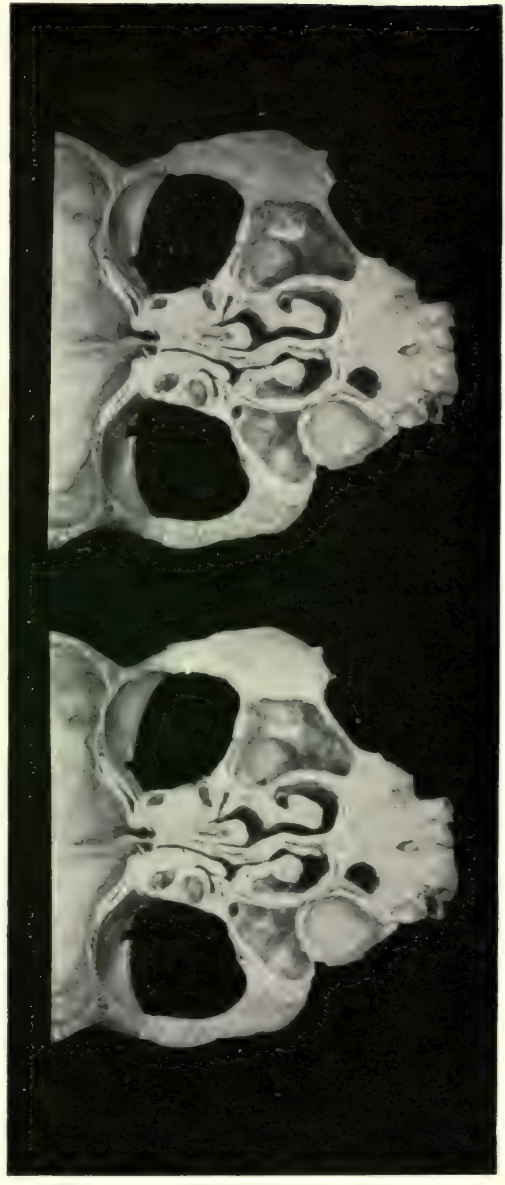


PLATE XXXVIII.—TRANSVERSE SECTION THROUGH THE SKULL.—Viewed from behind.

The maxillary antrum has been freely opened into the nasal passages by removing the inner wall and part of the inferior turbinated body. In this case the middle turbinated body has been left intact.

We are indebted to Messrs. Mayer and Meltzer for permission to reproduce this stereogram.

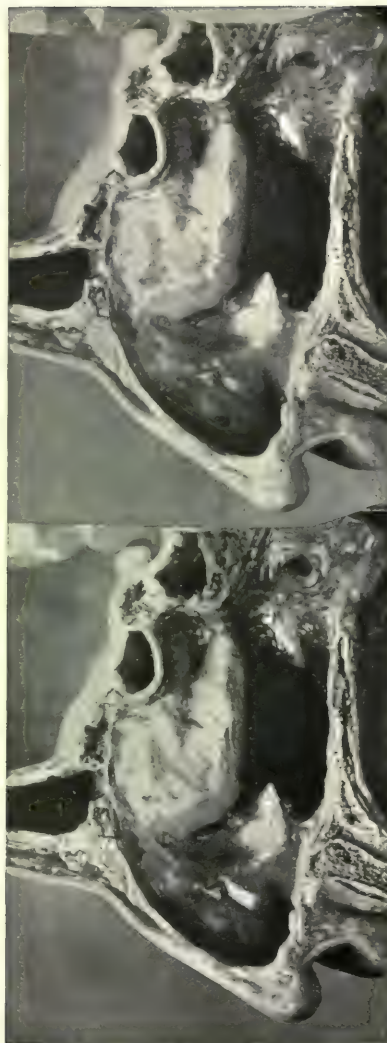


PLATE XXIX.—RADICAL OPERATION ON THE MAXILLARY ANTRUM.

An incision in the gingivo-labial angle, extending transversely from a point behind the first bicuspid tooth on one side to a similar point on the other side, allows the periosteum to be stripped upwards and the upper lip and anterior end of the nose to be raised, as in the commencement of Rouge's operation, exposing the anterior walls of the antra. The antral cavities are laid freely open by removal of the whole anterior walls. The antromental wall corresponding with the inferior meatus having been removed, the antral cavities become practically part of the nasal passages. The lip is then replaced, and the transverse incision in the gum sutured.

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HAJEK

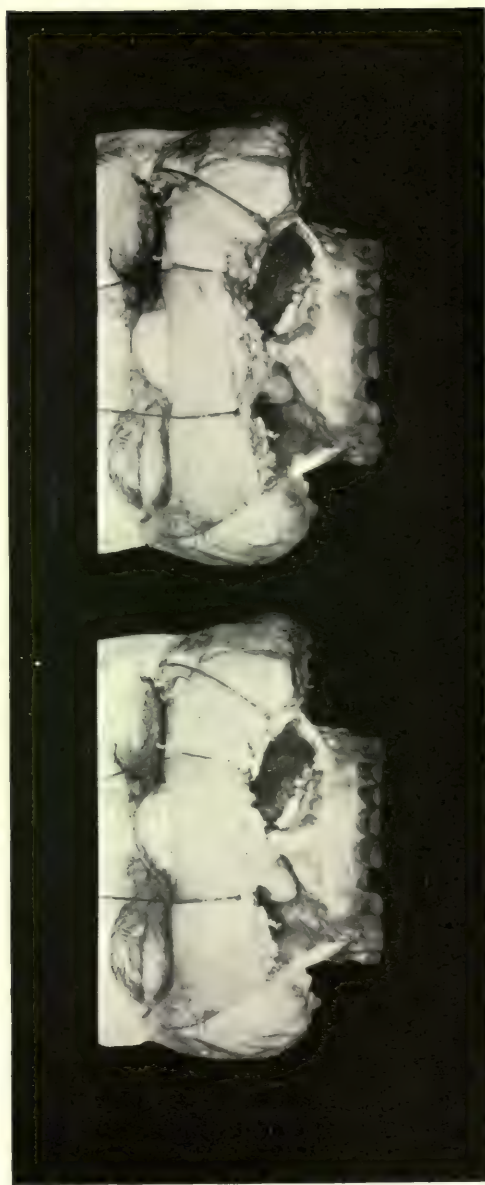


PLATE XL.—DENKER'S MODIFICATION OF THE CALDWELL-LUC RADICAL OPERATION ON THE MAXILLARY ANTRA.

On the left the whole anterior and inferior wall of the sinus, together with the nasal process of the superior maxillary bone, and the nasal bone of that side, have been removed, and the mucous membrane completely curetted away from the frontal sinus, together with free removal of the fronto-nasal ethmoidal cells. On the right side a small incision has been made, and the anterior wall of the frontal sinus trephined.

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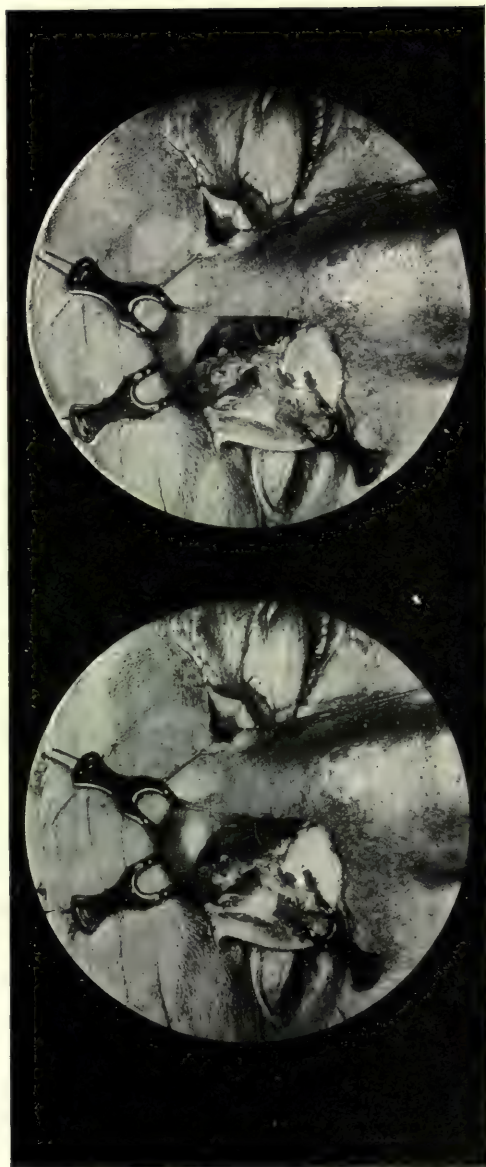


PLATE VII.—RIEDEL'S RADICAL FRONTAL SINUS OPERATION.

The author's osteoplastic radical operation for combined suppuration
in the frontal sinus, ethmoidal cells, and sphenoidal sinus, etc.—
"paranasitis."

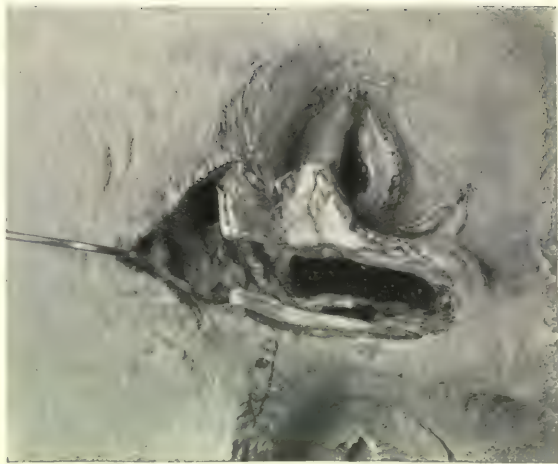
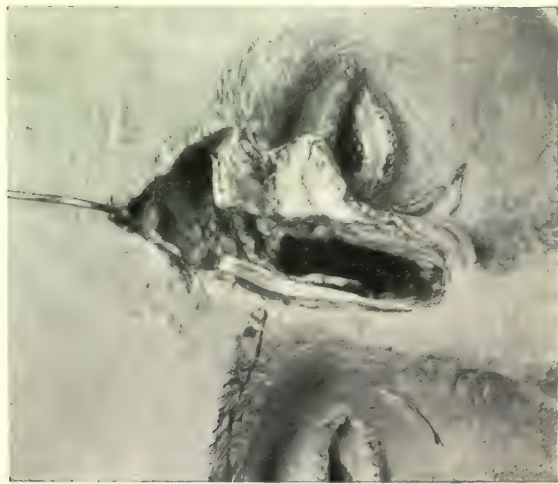


PLATE VIII.—WATSON WILLIAMS' OSTEOPLASTIC OPERATION ON THE FRONTAL SINUS.



PLATE XLIII.—KILLIAN'S RADICAL FRONTO-ETHMOIDAL SINUS OPERATION, SHOWING THE BRIDGE

HAJEK

KILLIAN

On the left side of the subject (right-hand side of the picture), Killian's operation is displayed; and on the other side is Hajek's modification, showing that there has been a much freer detachment of the orbital contents from the supra-orbital margin, giving freer access to the ethmoidal cells, which have been removed on both sides.

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PLATE XLII.—KILLIAN'S RADICAL OPERATION 'ON THE FRONTAL SINUS COMPARED WITH THE MODIFICATION OF THAT OPERATION DESCRIBED BY HAJEK

The anterior wall and the floor of the frontal sinus and the nasal bone, the nasal process of the superior maxillary bone, and the fronto-ethmoidal cells have been removed.

Photo by PROF. DELSAUX.



Causing an elastic, fluctuating swelling, with displacement of the eye downwards and outwards. An incision followed by evacuation and scraping of the sinus effected a cure.
Reproduced from Neisser's Atlas (Barth) by permission of Dr. L'athoff, Breslau.



PLATE XLVI.—MUCOCELE OF THE LEFT FRONTAL SINUS.

A frontal sinus catheter has been passed into
the left frontal sinus



PLATE XLIII.—STEREOSCOPIC SKIAGRAM, SHOWING LATERAL VIEW OF FRONTAL SINUS AND MAXILLARY ANTRA.

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